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The Inclusion of Cognitive Complexity: A Content Analysis of New Jersey's Current and Past Intended Curriculum

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**THE INCLUSION OF COGNITIVE COMPLEXITY: A CONTENT ANALYSIS OF NEW
JERSEY'S CURRENT AND PAST INTENDED CURRICULUM**

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Submitted in partial fulfillment of the
requirements for the degree of
Doctor of Education

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SETON HALL UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN SERVICES
OFFICE OF GRADUATE STUDIES

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Doctoral Candidate, **Dario Sforza**, has successfully defended and made the required modifications to the text of the doctoral dissertation for the **Ed.D.** during this **Fall Semester 2014**.

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ABSTRACT

Policy makers and educators have stated that the internationally benchmarked standards will place greater emphasis on 21st century skills including creativity, collaboration, critical thinking, presentation and demonstration, problem solving, research and inquiry, and career readiness. Many educators believe that if schools are “injected” with creativity, students will have a better chance at a prosperous and productive future. Are the current reform movements thwarting the opportunity for students to “find their own niche” and perhaps turning “them into disciples of ‘intellectual clones’ who will do ‘our thing’ rather their own?” (Sternberg, 2003, p. 335). In response to inquiry, this dissertation sought to examine the cognitive complexity of the nationally adopted Common Core State Standards in Grades 9-12 English Language Arts and Math as compared to the cognitive complexity of the New Jersey Core Curriculum Content Standards in Grades 9-12 English Language Arts and Math using Webb’s Depth of Knowledge framework.

My study aimed to reveal the extent to which 21st century skills, such as creativity, critical thinking, strategizing, and problem solving are “infused” into the Common Core State Standards as compared to 21st century skills infused into the New Jersey Core Curriculum Content Standards.

Webb’s Depth of Knowledge is directly linked to cognitive complexity, a measure of 21st century skills such as creativity and innovation. The present study employed a qualitative content analysis using Webb’s Depth of Knowledge methodology to code the standards. Deductive category application was used to connect Webb’s existing Depth of Knowledge framework to the existing CCSS and NJCCSS (Mayring, 2000). Each Depth of Knowledge level represents a specific level of cognitive complexity. The higher the DOK level of a standard, the more

cognitively complex the standard. The higher the cognitive complexity of a standard, the more creativity and innovation embedded into the standard. Each standard was rated on a 1-4 Depth of Knowledge level based on Webb's Depth of Knowledge methodology. The method used was a "double-rater read behind consensus model," which proved to be an effective "reliability check" when coding standards (Miles, Huberman, & Saldaña, 2014, p. 84; Sato, Lagunoff, & Worth, 2011, p. 11).

The major findings identified as the 9-12 Grade ELA and Math CCSS were compared to the NJCCCS, using the DOK framework, as follows:

1. When using DOK as an analytic framework, the findings indicate that overall both the Grades 9-12 ELA and Math NJCCCS (2008) were rated at a higher level of cognitive complexity as compared to the Grades 9-12 ELA and Math CCSS (2010).
2. The Grades 9-12 ELA NJCCCS were rated at an overall higher percentage of DOK Levels 3 and 4 than were the Grades 9-12 ELA CCSS.
3. The Grades 9-12 Math NJCCCS were rated at an overall higher percentage of DOK Levels 3 and 4 than were the Grades 9-12 Math CCSS.
4. The Grades 9-12 ELA and Math CCSS had a higher percentage of lower rated standards, DOK Levels 1 and 2, as compared to the Grades 9-12 ELA and Math NJCCCS.

This study provides an evidence-based evaluation of the decision of adopting the Common Core State Standards and their effectiveness in preparing students with the academically creative skills necessary to compete in our globally complex 21st century work environment. In addition to contributing to the scant research and literature on creativity in

education, policy makers and curriculum writers can use my methodology, as shown in this study, to assess future educational standards and assessments.

DEDICATION

After this long doctoral journey, I dedicate this project to the people that matter most to me, my family. Thank you to my parents, who made the decision to move to the United States from southern Italy to give their children a better life. My father instilled in me the work ethic, persistence, and resilience I would need to finish this study. My mother, well, there are not enough words to describe her unwavering love, compassion, support, and encouragement. Her strength has been the support that has carried me through to this day. To both my parents, I say thank you for introducing me to the real rock of our family, our strong faith. To my siblings, all of you have contributed to this study in ways that you cannot ever imagine. Our strong bonds, positive communication, and loving relationships allowed me to focus on my research without missing out on the important family moments.

I truly would not be where I am today if it were not for one person, my lovely and patient wife, Bernadette. Your unrelenting support of what sometimes seemed like a blurry vision has been priceless. I will be forever in debt to you for the numerous sacrifices that you made in order for me to succeed in completing my doctoral degree. To my beautiful wife, I say simply thank you and I love you.

Last, I dedicate this to my nephews on earth and my one and only Angel that watched over me through every step of this journey, my niece in heaven, Angelina. Angelina, I learned more from your strength, determination, and perseverance at the tender age of three than anyone I had ever met before. Your smile and love of life were contagious, which is no wonder why God wanted you all to himself. I dedicate this to you, sweetheart. You will always be original and can never be replaced.

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CHAPTER I

INTRODUCTION

Essential skills, such as critical thinking and creativity, which are necessary in order for students to succeed in a knowledge-based 21st century economy, have gained a “growing appreciation” in business and education industries over the past 10 years. Schools across the country have been increasingly challenged to prepare students with 21st century competencies to compete in a global economy (Kyllonen, 2012, p. 3). While educational policy makers continue to focus on academic rigor and a standardized education system, business leaders require students, as the future workforce, to develop creativity, strategizing complexity, adaptability, and innovation as well as analytical and problem-solving skills (American Society for Training and Development, 2009; IBM Study, 2010; Kyllonen, 2012; Adobe, 2012). *The Competitiveness and Innovative Capacity Report* states that “given the pace of change in today’s global economy, investments to promote innovation deserve more emphasis than at any time in the past” (U.S. Department of Commerce, 2012, pp. 2-3). Throughout this study, the terms cognitive complexity, creativity, innovation, analytical thinking, and problem-solving skills have been used synonymously with 21st century skills.

There has been growing concern that there is a large void of these skills in today’s workforce (Waters, 2013). In their *Bridging the Skills Gap* (2010) report, the American Society for Training and Development (ASTD) identified “innovative thinking and action—the ability to think creatively and to generate new ideas and solutions to challenges at work” as one of the most important competencies and skills needed to succeed in the 21st century global economy (p. 13). As such, students will not be able to face the demands of a 21st century workforce if schools do not prepare them with the skills to “create and innovate” (NEA, 2012, p. 24). Global

educational leaders are working to reverse the way in which teaching and learning takes place in the classroom by incorporating creativity into the curriculum and improving students' intellectual capacity in a variety of ways rather than relying solely on what IQ measures (Voelpel, 2007; Bronson & Merryman, 2010; PISA, 2009, 2012; Finegold & Notabartolo, 2008).

As one of the most important competencies in today's economy, creativity has the potential to build confidence in future leaders while allowing them to be competent despite economic uncertainty, leading them to make new and innovative business decisions (IBM, 2010; Bronson & Merryman, 2010). The ingenuity and creative capacity of our youth is critical to (re)building our economy (Adobe, 2012; Kyllonen, 2012; NEA, 2010). However, our students seem to lack the creative skills necessary to compete in a global economy. Sternberg (2003) argues that schools reward students that are able to possess recall and recitation skills but should be "nurturing and rewarding rather than ignoring or even punishing students who are high in creative or practical skills" (p. 325).

Although United States' school leaders and policy makers have prized originality and academic curiosity, American ingenuity has declined over the past ten years (Kyllonen, 2012; Bronson & Merryman, 2010). From a meta-analysis study on cognitive skills to a survey of more than 400 employers from a range of industries, Kyllonen (2012) highlights how the United States is not meeting the status quo and is indeed lagging behind other countries in 21st century competencies such as creativity, innovation, critical thinking, and problem solving (p. 7). The McKinsey Global Institute study, which surveyed over 2,000 business leaders, found that job applicants were severely lacking 21st century skills such as problem solving and communication. (Manyika, Lund, Auguste, Mendonca, Welsh, & Ramaswamy, 2011). In the State of Create Global Benchmark Study (2012), it was found that 62% of Americans feel that our education

system is to blame for blocking their creative talent. Though innovation capacity is essential in order to create more jobs and compete in a global economy, the United States is losing its economic competitiveness due to a lack of innovation (Adobe, 2012).

Nevertheless, the standards movement in the United States is gaining momentum and thereby all curricular decisions will be built upon this mandated national prescription of learning, raising a concern about the United States gaining a competitive edge in the struggling national and global economy (SHRM, 2007; Tienken & Orlich 2013; Zhao, 2012). The National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO), the creators of the Common Core State Standards (2010), have pushed forward the new standards as a way to provide a standardized national prescription of objectives that focus on innovative and creative thinking. Although economists recognize the importance of creative and analytical thinking for the creation of new jobs, a nationalized and standardized curriculum could be thwarting the need for change (Sternberg, 1999, p. 3). Currently adopted by 45 states and the District of Columbia, the NGA and CCSSO contend that the standards will emphasize the critical thinking, problem-solving, and creativity skills business leaders are looking for in our students. Furthermore, the creators of the CCSS feel that a nationalized curriculum will benefit education in the United States because all students, regardless of socioeconomic status or geographic region, will be offered the opportunity to receive the same required knowledge (CCSSO, 2014).

Critics of the standards movement argue that a prescribed curriculum will do little to promote the creative competitive edge. According to Zhao (2012), a prescribed curriculum, such as the Common Core State Standards, mimics an employee-oriented system of education where student knowledge is limited to what policy makers think students will need to succeed in the future. Race to the Top, a federally funded program, offered incentives to states to adopt and

implement the CCSS before any wide scale studies had proved their validity. In addition, little empirical evidence exists that examines the validity of the CCSS (Tienken & Orlich, 2013, p. 104). Niebling (2012) contends that our country's rationale for creating better standards is due to our continued comparison to other countries and how we are lagging behind these countries. Several critics argue that the CCSS were rushed to be completed and were untested and inaccurately benchmarked (Ravitch, 2013; Tienken & Orlich, 2013, p. 107). Critics contend that current policy makers are under the illusion that by simply adopting or making standards better, instruction and assessments will magically change. (Niebling, 2012; Tienken & Orlich, 2013).

Common Core Resistance Across States

Zhao (2012) argues that a prescribed set of standards, such as the Common Core, will have a negative impact on the United States, a nation where specific talents, creativity, innovation, and entrepreneurship are valued. If the drive behind the Common Core is to produce high tests scores on international assessments, as opposed to cultivating the creative talents of our youth, then students would be discouraged from becoming creative, analytic, and critical thinkers (Zhao, 2012). A study by ACT (2010) found that students would not meet the expected level of academic achievement and college and career readiness skills outlined by the CCSS if tested on them today (ACT, 2010). This proved true for New York Public schools, for example, as school officials saw a significant drop in test scores after the adoption of the CCSS. The academic drop in test scores has pressured school officials to delay accountability and mastery of the CCSS for high school students until 2022 (Belanger, 2014). Today many more states are calling into question the validity and reliability of the standards and as a result either have dropped out of the PARCC, the assessments being created to assess mastery of the CCSS, or are considering dropping or revising the CCSS. In some cases, states such as New Hampshire,

Indiana, and Georgia are dropping both the CCSS and the PARCC assessments altogether, and New Jersey is not exempt from this list. According to Schneider (2013), over a third of the states that have adopted the CCSS are now showing resistance towards the national prescription. In November of 2013, the Alabama school board that advocated for the adoption of the Common Core voted to rescind its own vote. That same month, Florida's state superintendent of schools requested that full adoption of the CCSS be delayed three years; and lawmakers from New Hampshire, Indiana, and Georgia introduced bills to completely drop the Common Core. An outspoken Kentucky activist questioned the "legality of the common core" in a recent lawsuit against the state and Louisiana's state superintendent implemented a two-year delay of the accountability requirements of the Common Core and a ten-year review of the validity of the CCSS. The Massachusetts Board of Education voted in November of 2013 to delay Common Core implementation by two years while it researches the validity of the PARCC assessments as compared to their nationally recognized Massachusetts Comprehensive Assessment System (MCAS) Exam.

New Jersey is also questioning the validity and reliability of the Common Core. Among the states that adopted the CCSS, New Jersey was one of the states that quickly signed onto the Common Core before any wide-scale studies had been completed to prove its validity. In November of 2013, 12 New Jersey senators asked the Commissioner of Education for more details on the Common Core, including the cost, student performance methods, and how student information will be kept private (Schneider, 2013). A New Jersey senator and an assemblywoman went as far as to introduce two separate, but similar, bills that would create a "Common Core State Standards evaluation task force," which would delay the PARCC assessments in New Jersey until the task force completes its report (Vanderhart, 2013). In the

interim, New Jersey's Department of Education has agreed to delay the graduation requirements tied to the new PARCC assessments, being fully implemented in the 2014-2015 school year, for at least three years.

21st Century Skills: Creativity and Innovation

Cisco Systems Incorporated, Intel Corporation, Microsoft Corporation, and the University of Melbourne (2010) organized a study called The Assessing and Teaching of 21st Century Skills (ATC21S) to define and categorize 21st century skills. The ATC21S study categorized 21st century skills into four categories:

- Ways of thinking: creativity, critical thinking, problem solving, decision making, and learning
- Ways of working: communication and collaboration
- Tools for working: information and communications technology (ICT) and information literacy
- Skills for living in the world: citizenship, life and career, and personal and social responsibility

As one of the *ways of thinking*, “Creativity is at the foundation of innovation and is vital for our country’s growth and development. Creativity fuels all areas of our country's economy and prosperity” (Turnipseed, 2012, par. 3). Creativity is cognitively complex and often involves many different internal and external processes (Runco, 2007, p. 13).

Jackson (2003), in her book *Envisioning a 21st Century Science and Engineering Workforce for the United States*, contends that the United States’ strength, economic success, and technological superiority depend on the innovation and creativity of our science and engineering workforce. The NEA’s P-21 Partnership for 21st Century Skills study sums up three ways to

define creativity and innovation: the ability to think, working creatively with others, and implementing innovation (NEA, 2012). Webb's Alignment Tool (WAT) has been used as a framework to align standards with assessments, gaining national and international recognition; most recently, its ability to enable researchers to code and analyze standards based on their complexity levels, has made it a very attractive and reliable tool (Porter, McMaken, & Hwang, 2011; Florida State University CPALMS, 2012; Sato, Lagunoff, & Worth, 2011; Yuan & Le, 2012).

Webb defines four levels of cognitive complexity as Depth of Knowledge (DOK) levels. Gamoran, Porter, Smithson, and White (1997) found that when internal processes of cognitive complexity are increased in an intended and enacted curriculum, external factors such as socio-economic status and ethnic background; i.e., a student's "home life," will play less of a role in affecting a students' academic potential (pp. 326-327). In this study, Webb's DOK was used to assess the cognitive demand of a standard and gauge the creative potential of the standard. Every standard objective, based on its intended outcome, will "reflect a different level of cognitive expectation, or depth of knowledge, required to complete the task" of that standard (Parker, 2009, p. 5). Depth of Knowledge could be any form of knowledge, from *declarative* knowledge, which is based on facts, to *procedural* knowledge, which represents the "know-how" and "dictates procedures for strategic thinking, and much of creativity is strategic" (Runco & Chand, 1995, p. 245). Declarative knowledge is directly linked to procedural knowledge, and together they can promote creative thinking. If the "know-how" of standards is understood during their creation, then the standards, which could be classified as intended procedural knowledge, can potentially increase "originality and flexibility," some of the critical ingredients of creativity and innovation (Runco & Chand, 1995, p. 245). The cognitive potential of

procedural and declarative knowledge is necessary, but limited. Procedural and declarative knowledge provides only the foundation needed to reach complex and extended forms of thinking. If deeper levels of cognitive demand are absent and content standards are more repetitive in nature, then complex efforts to help our students be creative and original can be jeopardized (Runco & Chand, 1995, p. 245). Standards are also considered requisite knowledge, pre-inventive structures needed to reach extended levels of strategic thinking (as cited in Ward et al., 2010, p. 190). This study attempted to systematically analyze the distribution of cognitive complexity within the standards. The objective of this study was to assess the depth of the “cues” embedded in the language of the standard in order to determine if each standard helps a student develop creative and original thinking. An intended curriculum that is low in complexity and depth of knowledge will make it difficult for students to develop essential 21st century skills that lead to creative and original thought (Gardiner, 1972, p. 327). On the other hand, an intended curriculum high in complexity and depth of knowledge will enhance a student’s creative and extended levels of thinking by requiring them to “make multiple connections between several different key and complex concepts” (Gardiner, 1972, p. 327; Webb, 2005).

Purpose of the Study

The purpose of this qualitative content analysis study was to describe and compare the distribution of cognitive complexity within the English Language Arts and Math Common Core State Standards (CCSS) and the New Jersey Core Curriculum Content Standards (NJCCCS) in Grades 9-12. There has not been a qualitative study that has used DOK to look at creativity and the CCSS and NJCCCS. New Jersey adopted the Common Core in 2010 to replace its Language Arts Literacy and Math standards (2008) with the CCSS English Language Arts and Math standards (2010), thus making ELA and Math the two content areas that were chosen for my

research study. The creators of the CCSS did not create other standards outside ELA and Math. Grades lower than Grade 8 seemed less hopeful of finding standards high in cognitive complexity; therefore, I chose all high school grades, Grades 9-12, as the grade levels for this study (Cook, 2007). In addition, high school students in the United States are typically about the same age, 15-17 years old, as students tested on international tests such as the PISA and TIMMS. Last, high school is the gateway to college and careers, and assessing the intended curriculum for these grade levels allowed me to understand if we are truly preparing our high school students with the essential 21st century skills needed for them to enter and succeed in the post-secondary world.

Research Questions

1. To what extent is cognitive complexity, as defined by Webb's Depth of Knowledge, embedded in the Common Core State Standards for English Language Arts and Mathematics, Grades 9-12?
2. To what extent is cognitive complexity, as defined by Webb's Depth of Knowledge, embedded in the New Jersey Core Curriculum Content Standards for English Language Arts and Mathematics, Grades 9-12?
3. What differences and similarities exist in cognitive complexity between the Common Core State Standards and New Jersey Core Curriculum Content Standards in English Language Arts and Mathematics for Grades 9-12?

Conceptual Framework

Webb's Depth of Knowledge (DOK) was utilized as the conceptual framework for the present study. Webb's DOK consists of four levels of knowledge. Webb's Depth of Knowledge Level 1, recall, and Level 2, skills and concepts, are levels that require basic knowledge

recitation and comprehension. No creative thinking is taking place in DOK Levels 1 and 2. Webb's Depth of Knowledge Level 3, strategic thinking and complex reasoning, and Level 4, extended levels of thinking, are where students would be able to reach deeper, analytical, and more strategic/extended levels of thinking and complex reasoning. This is where researchers argue that creativity begins. This is in large contrast to Webb's DOK Levels 1 and 2, which ask students to complete basic recall and application of skills and concepts (Webb, 2005). If the standards do not have the necessary flexibility, students will be unable to break through the fixed and rigid objectives in order to make the complex connections needed to reach a Webb DOK 3 and 4 level of cognition. If there is no flexibility to the standards, students will reach what Smith & Tindell (1997) call a "memory block" or what Runco et al. (1995) call "functional fixedness" (p. 247, p. 355). The one-size-fits-all standardization of an intended curriculum can deplete creative talent if the formulation focuses solely on declarative and procedural knowledge; that is, a Webb DOK Level 1 or 2 only, retrieve and recall (Runco & Chand, 2005, p. 248). Given that the CCSS has been adopted by over 90% of schools in the United States and that, according to studies such as the State of Create Global Benchmark Study (2011), which found that creativity within the United States is declining, it is critical that the CCSS intended curriculum encompasses creativity. Furthermore, it is important to determine if the standards contain the complexity needed for students to develop high levels of creativity and critical thinking skills (Ward et al., 2010).

Significance of the Study

Creativity and innovation matter because the future of the U.S. economy depends on it (Parks, 2010; IBM, 2010; NEA, 2010). Studies show that creativity has seen a steady decline in the United States in the last 20 years (Turnipseed, 2012). "Our country's creative capacity will

determine our economic success or failure for the next several generations” (Morrison, 2010). The speed at which “technological innovation” is changing is rapid and the “ability of individuals to adapt and innovate is now vital at all levels of the economy” (Finegold & Notabartolo, 2008, p. 15). Researchers have attempted to measure creativity for well over 50 years. James C. Kaufman, professor at California State University, San Bernardino, says that “creativity can be taught” and learned over time (qtd. in Bronson & Merryman, 2010, par. 20). Creative and critical thinking can and should be embedded into our academics and schools, and when combined with academic rigor can formulate very powerful 21st century school curricula (Sternberg, 1999, p. 3; Craft, 2005; Padget, 2013; Trilling & Fadel, 2009, pp. 96-97). These skills are aligned with demands highlighted in the 2012 issue of *Economic Crisis*. Scholarship has identified three specific academic skills necessary to succeed in the 21st century: critical thinking and problem solving, communication and collaboration, and creativity and innovation (NEA, 2012; Kyllonen, 2012). With such a large economic focus on the importance to harness creative and innovative skills for our schools, my study may provide an additional benefit to Webb’s DOK framework for writers of academic content standards: the ability to assess creativity.

Education policy makers in the United States and New Jersey are expediting and mandating nationally accepted standards at an alarming pace. No research has been conducted to assess how much more cognitively complex and creative the CCSS are compared to the NJCCCS. This study expands on the literature and provides policy makers with an empirically based framework that can assess creativity within an intended school curriculum. There have been previous studies that used Webb’s framework to measure Depth of Knowledge of the Common Core State Standards. For example, Florida’s State University CPALMS (2012) study

measures the DOK of the CCSS but gives a DOK rating to each standard as a whole and not the specific strands. This study intends to be more in depth by assigning a DOK rating to all standards and strands in an attempt to provide a clearer picture of DOK distribution among the standards. In addition, although there have been comprehensive studies that have used DOK to code the CCSS, most have been for alignment between standards and assessments. Similar to my study, Chi, Garcia, Surber, and Trautman (2011) used Webb's methodology for a standards-to-standards alignment. Along with Webb's methodology, Chi et al. (2011) also used Cook's (2007) framework to align the English Language Arts and Math CCSS to the WIDA (2007) English Language Arts and Math standards. Chi et al. (2011) analyzed the breadth, depth, and correspondence of the CCSS in Grades K-12 to the WIDA standards in order to prove to member states that their standards directly correlate and link to the CCSS. My study took the current research to the next level, as it sought to describe and compare the Depth of Knowledge distribution of the Common Core State Standards to that of a state's previous educational standards. My study sought to fill the gaps in the literature by using DOK as a measure to assess the creative potential of each standard objective as well as assessing whether adopting the CCSS was a good choice for the creativity and innovation of New Jersey high schools.

Previous national and state standards movements under NCLB have decreased the flexibility in creative teaching and learning in the classroom, and national assessment data published after the implementation of the CCSS indicate a drop in U.S. performance (Guisbond, Neill, & Schaeffer, 2012). In the PISA 2009 summary, the Organization for Economic Co-operation and Development (OECD) published data on schools around the globe. Specifically, PISA (2009) focuses on "young people's abilities, knowledge and skills to meet real-life challenges" (p. 3). The PISA reports are formidable documents that the United States and other

countries take very seriously. Historically, PISA findings have forced policy makers to make educational decisions, such as the creation of the Common Core State Standards, which have national implications for American schools. “In other words, the prevailing hypothesis is that the observed student learning outcomes (that are lagging behind those of other countries) are caused by insufficient standards that in turn are causing insufficient instruction” (Niebling, 2012, p. 2). Similar to assessing the cognitive complexity of a standard objective, PISA does not look at repetition; that is, how many times students can repeat a math problem. Rather, they test students’ cognitive command and application of knowledge. PISA has strong 21st century skill goals “such as understanding other ways of doing, thinking and being” (PISA, 2009, p. 6). This study’s intent was to assess whether a deeper level of critical and creative thinking is manifested within the CCSS and NJCCCS. This study can assist standard and curriculum developers, policy and test makers, and teachers and school leaders in validating the effectiveness of a new intended curriculum prior to its implementation.

The Partnership for Assessment of Readiness for College & Careers (PARCC), the standardized test being used to assess mastery of the CCSS, states, “The Common Core will shift from basic knowledge to an emphasis on performance” (2012). Standardized testing allows educational leaders to easily assess a large population of students. Standardization can be an efficient assessment tool in the eyes of policy makers; but it can also discourage creativity, not allowing students to think outside the prescribed domain of intelligence or even attempt to “challenge the status quo” (Zhao, 2012.) Kyllonen’s (2012) study attempts to prove that the United States is not meeting the status quo and is indeed lagging behind other countries in 21st century competencies, such as critical thinking and problems solving (p. 7). To the contrary of what the creators of the CCSS might have expected, the latest PISA (2012) rankings show the

United States, after a majority of the states adopted the Common Core, dropping below the OECD average in mathematics (PISA, 2012). It was the intent of this study to examine the CCSS, using Webb's DOK, to help policy makers understand why there has been a recent drop in the OECD average in mathematics.

Switching to a Common Core set of standards could potentially boost future U.S. PISA scores, but benefits might not be seen for a long time. "Evans expects the class of 2020—today's fifth graders—will be the first to fully benefit from the Common Core . . . these students will be producers, not just consumers of content" (Shein, 2013, p. 32). The fundamental issue skeptics have with the CCSS is that there exists no large-scale research that assesses its validity. Although my study did not field test or align standards to assessments, it may help teachers, curriculum developers, and policy makers understand whether some of the critical 21st century skills, such as creativity, critical thinking, and the opportunity to innovate, are really embedded within the Grades 9-12 CCSS. If creativity, strategizing, and critical thinking are not built into the CCSS, schools could be forced to allocate additional funds to purchase products that help supplement the lack of essential 21st century skills absent from the CCSS (Tienken & Orlich, 2013, pp. 77-79; Trilling & Fadel, 2009, p. 84). Will the new standards meet the needs of New Jersey high schools students' ability to build creative, analytical, and practical skills while retaining academic rigor? The research findings of this study can provide experts with a tool that will help develop standards that promote creativity, critical thinking, innovation, and extended levels of learning.

According to recent national rankings, New Jersey already had a quality education system, which in part could have been due to a strong set of standards prior to the adoption of the Common Core (NEA, 2010; NJSBA, 2011). With federal Race to the Top funds on the horizon,

New Jersey, amongst other states, was quick to sign on to the Common Core. The National Assessment for Educational Progress (NAEP, 2011) ranked New Jersey at the very top of the list (the top five) in reading, writing, and math scores. *Education Week* (2011, June 7) highlighted New Jersey's excellent graduation rate, "Number 1" in the nation, which was 15% points higher than the national average (Education Research Center, 2011). The National Center for Public Policy rated New Jersey an "A" on college and career readiness, and New Jersey ranked "Number 1" in the nation for students who scored three or higher on their Advanced Placement (AP) test (College Board, 2012). The College Board also addressed New Jersey's SAT scores, which are at the highest they have ever been and continuing to increase (College Board, 2012). These rankings are important because they are based on assessments (SAT, NAEP, AP, ELA, and Math) that measure college and career potential, the quality of New Jersey's education on a national level, and national ELA and Math performance, the two content areas used in this study. This study sought to reveal whether a correlation exists between the old and new standards in New Jersey and justify whether the millions of dollars spent on transitioning from the past to the current intended curriculum will truly prepare New Jersey students to be more college and career ready.

As many questions remain to be answered regarding the validity of the CCSS and gaps in the literature regarding any large scale studies of the CCSS, let alone the creative potential embedded in it, this research sought to shed light on whether the cognitive demand of the CCSS measures up to the 21st century thinking skills students need to succeed in today's complex economy. Stiglitz (2012) contends that we should learn from the Great Depression that the United States is up against a comparable revolution from "industry to service" today (para. 1). Education has proven to be a major economic investment; therefore, if the CCSS policy makers'

educational answer to meeting economic challenges, adopted by 90% of the schools in the United States, falls short of its promises, the United States could face “a tragic replay of 80 years ago,” the Great Depression (Rolnick & Grunewald, 2007; Stiglitz, 2012, para.1). This research, at least for New Jersey Schools, sought to uncover some of the misconceptions of the new benchmark standards (Tienken, 2011; Zhao, 2009). Our standards should meet the needs of all students, not only the creatively gifted because “self-expression in creative ways satisfies the needs of the imagination; this need is not found in the so-called ‘creative type’ of student only” but in all students (Aiken, 1942). My study can offer some insight as to whether the CCSS could be used as a means to prepare New Jersey high school students for the creative competitiveness necessary to succeed in a 21st century work environment.

Summary/Organization of the Dissertation

In Chapter I, I highlight some key issues regarding the importance of nurturing 21st century skills such as creativity, critical and strategic thinking, and innovation, within the United States’ intended curriculum. The gaps in the literature regarding the assessment of these skills within New Jersey’s past and present intended curriculum made it necessary and significant to complete this research study. The remainder of this study is organized as follows. Chapter II begins with definitions and a historical overview of creativity, followed by an analysis of the links between creativity and critical thinking as well as between creativity and cognitive complexity. In the second part of Chapter II, I discuss past and present educational reform movements that have led to our current state of standardization. A review of the CCSS and NJCCCS is included in Chapter II. The final section of Chapter II includes an in-depth analysis of the many different and current frameworks being used to assess cognitive complexity and ends with a description of the theoretical framework, Webb’s Depth of Knowledge, used for this

study. In Chapter III, I describe the methodology used for this study. The chapter includes an introduction of the study, my three research questions, and a detailed description of the purpose/design of this study. Additional components of Chapter III include a review of the coding scheme used, a description of my trained consultant coders' qualifications and experience, my method of ensuring credibility, the training involved before coding the standards, and my method of analyzing the standards based on Webb's Depth of Knowledge. Chapter IV draws attention to the findings of this study, answering with data all three research questions. Last, Chapter V includes a summary of the study, brief comments on the findings, a conclusion, and policy, practice and future research recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

This chapter discusses standardization, creativity, cognitive complexity, and their importance and relationship to one another. This chapter also discusses the history of the study of creative thinking and a brief history and overview of the major perspectives in modern day standardization as well as the link between creative and critical thinking. I introduce cognitive complexity and creativity and how they are linked to each other. Webb's Depth of Knowledge was used as a theoretical framework for this study. The chapter concludes with an analysis and description of Webb's Depth of Knowledge framework and its use to assess cognitive complexity within standards.

History of Creative Thinking

The term *creativity* most probably derived from the Indo-European root *ker* or *kere* (to grow) via the Latin *creation* or *creates* (to make grow), and ultimately means to "bring something new into being" (Weiner, 2000, p. 8; Glaveanu, 2013, p. 69). A researcher can unpack literature in the field of creativity and creative thinking and get a thousand different definitions for it. Perhaps this is because the concept of creatively complex thinking does not have one right answer to it, but many different answers and ways of arriving at the definition or conclusion to a problem. That is the beauty behind creative thinking. As Clark (2008) put it, "Creativity is one of those interesting fields that mirrors the very topic it studies; just as creativity is complex and multi-faceted, so too are the approaches to its study" (p. 25).

Researchers such as Sternberg (1993) say that creativity is "the aptitude to generate work that is unique and original as well as suitable for the specific task or problem one is attempting to

solve” (Sternberg, 1999, p. 3). Albert and Runco, (1999) eloquently share their perspective on creativity:

The early conceptualizations of creativity and research were in themselves exceptional creative acts, as was the eventual bridging of these concepts through deliberately applying research methods. These methods were essential not only to the meaning and significance of creativity in human experience, but to why and how historical events were set in motion. Understanding this should help us appreciate . . . creativity within history (p. 16).

Creativity is relevant when one is solving problems and builds on the foundation of knowledge (Sternberg, 1999, p. 3; Craft, 2005). Runco and Jaeger (2012) claim that creativity does not need two different standards. They believe that the original research on creativity focused primarily on the originality involved, but in essence this is not enough to deem someone or something creative (p. 92). “Original things must be effective to be creative,” so creative thinking would mean nothing if it did not lead to something productive or effective (Runco, 2012, p. 92). Csikszentmihalyi (1996) contends that the “idea or product that deserves the label ‘creative’ arises from the synergy of many sources and not only from the mind of a single person . . . and “comes after years of hard work” (Csikszentmihalyi, 1996, p. 10). Csikszentmihalyi went on to discuss two main reasons creativity is essential in our lives. “First, most of the things that are interesting, important, and human are the results of creativity,” and second, “when we are involved in creativity, it adds a fulfillment to our lives leaving an outcome that adds richness and complexity of the future” (Csikszentmihalyi, 1996, p. 11).

Creativity has its roots embedded deep in cognitive psychology, as far back as the 1800s. However, due to the changing and competitive global economy, there has been a renewed

interest in infusing creativity into education reform during the past two decades (Craft, 2005). In the business world, we might hear the term *innovation* being used synonymously with creativity. To be innovative is to come up with an idea that is original and purposeful; the same has been stated about creativity. Craft (2005) states that innovation is the “implementation of new ideas to create something of value,” increasing its attention in today’s global marketplace (Craft, 2005, p. 16). Business leaders are looking for innovators, individuals who can think globally and in complex new ways; this requires acquired creative thought and skills.

The goal of the new Common Core State Standards released in 2010 is to provide a foundation for innovative and creative thinking. Economists are realizing the importance of this for the creation of new jobs, but nationalized standards could be thwarting the need for change (Sternberg, 1999, p. 3). Although creativity has a foundation in the field of psychology, it has often had to take the back seat due to what Sternberg (1999) calls “roadblocks” (p. 4). The roadblocks are quite simply some of the many different approaches to viewing creativity, which are the “mystical, psychoanalytic, pragmatic, psychometric, cognitive, and social personality” (Sternberg, 1999, p. 4).

Creativity should be thought of as a collaborative effort. Padgett (2013) contends that “most modern human achievements are the result of teamwork; groups of individuals—jigsaw puzzles of different coordinated talents and aptitudes, experiences and enthusiasms” (p. 22). These aptitudes work together to create a film, a television advertisement, a motorcar, a drug to fight cancer, or a curriculum; these are the results of collaborative creativity (p. 22). Padgett goes on to argue that the difference between creativity of the past and creativity of the future is that creativity of the future will be a critical aspect of survival (Padgett, 2013). The mystical approach to creativity seems to have been a main roadblock within creativity research due to its vagueness

and often spiritual-in-nature approach; therefore, it was often not accepted as being scientific (Padget, 2013, p. 5). Similar to Plato-like assumptions, “the creative person was seen as an empty vessel that a divine being would fill with inspiration” (Padget, 2013, p. 5).

Galton (1869) was one of the first individuals to study this “mystical” topic. Galton’s work centered on the creativity of genius (Gorny, 2007). Galton believed that intelligence, and therefore creativity, was genetic in nature. Even though Galton is thought of as the founding father of psychometric and historiometric models of creativity, future researchers disregarded his theory that intelligence and creative genius were hereditary (Gorny, 2007). Following Galton’s work, the term *genius* was still heavily attached to the study of creative thinking as outlined in Terman’s (1925) work titled *Genetic Studies of Genius* (as cited in Gorney, 2007). Famous historical studies of what Cox (1926) called “eminent creators” were conducted as researchers continued to link creativity with motivation, self-confidence in work, and strong sense of self (as cited in Gorney, 2007; Albert et al., 2009, p. 27). This study attempted to reveal if the Common Core has the characteristics and flexibility necessary to make students feel the motivation and self-confidence needed to be an “eminent creator.” Historical research on creative and critical thinking was in itself a way of compiling original ideas and theories that would prove to be essential and purposeful (Albert & Runco, 2009, pp. 16-17). This research and the steps it takes to connect the literature on creativity from the past 200 years to modern day educational reform movements is creative, original, and purposeful.

For many years scholarship on creativity was not an accepted form of research; perhaps this is why there has been a paucity of literature within the field of creative thinking. It took a century and half for the topic of creativity to truly be accepted as a form of institutional research (Albert et al., 2009, p. 17). Feist and Runco (1993) and Guilford (1950) recognized and publicly

wrote about the dearth of books, articles, and in today's world, web resources on creativity and critical thinking (as cited in Albert et al., 2009, p. 17). This dearth demonstrates the need for this research on the cognitive creative demand of our new national intended curriculum as well as further research needed in the field.

The problem-solving approach to creativity was introduced by Csikszentmihalyi and Getzel (1971), who studied a group of art students during an 18-year period. Csikszentmihalyi and Getzel found that the students that were successful in using problem-finding skills in the controlled environment produced more original, and more importantly, productive pieces of art in the natural environment (as cited in Chand & Runco, 1995, p. 253). Environment, place, and time have played, and still play, an important role in nurturing creative skills and studying creativity research. In order for scientists such as Copernicus (1473-1574), Galileo (1564-1642), and Newton (1642-1727) to generate theories that would re-shape our world, they had to be creative in their thinking. Although Copernicus believed in a sun-centered universe, Galileo was not permitted to express such a heretical belief. The church professed an earth-centered (geocentric theory) universe; thus, no one was to believe or think or study anything else. This force of power and of one-way thinking does not allow one to discover and create original ideas. Tienken and Orlich (2013) dub this “collective punishment” (p. 39). Standardization and a nationalization of our public school curriculum could be punishing and forcing our students to follow the same Biblical-type doctrines of the 16th and 17th centuries that hampered scientific progress. Albert and Runco (2009) wrote about four essential ingredients of creativity that came out of the 18th century: “ (a) genius was divorced from the supernatural; (b) genius, although exceptional, was a potential in every individual; (c) talent and genius were to be distinguished from one another; and (d) their potential and exercise depend on the political atmosphere at the

time” (p. 22). Perhaps the work of Bethune as far back as 1837 is closely connected to the Freudian ideas of creativity and cognition today. Level 4 of Webb’s Depth of Knowledge framework refers to extended thinking and being able to connect different sources of information to arrive at an original conclusion. Becker (1995) discussed how Bethune (1837) was able to understand that connections between present and past learned experiences would lead to originality and creativity (p.220). Another term often heard, but misinterpreted, in the creative field is divergent thinking. The concept of divergent thinking can be traced as far back as 1877, when Jevons described it as “diverging from the ordinary grooves of thought and action” (Jevons, 1977, p. 576). Similar to the many attempts to define creativity, there is no one-size-fits-all standard with divergent thinking. It can also be thought about as an unconventional way of thinking that leads not only to original, but useful, thought (Csikszentmihalyi, 1996, pp. 69, 70, 83, 378). I would be remiss if I did not briefly mention Howard Gardner (2000), a pioneer in the study of creativity in the 20th century.

Gardner’s famous studies centered on the “creative geniuses of the century,” but it was J. P. Guilford’s (1950, 1967) work before him that gave us a clear understanding between convergent and divergent thinking. (Csikszentmihalyi, 1996, p. 420). Guilford’s studies were very similar to Paul E. Torrance’s, except he felt divergent thinking and creative thinking should not be related or compared to each other (Kim, 2006). Paul Torrance is known as another pioneer of creativity research with his work on assessing creative intelligence. Torrance (1988) believed that IQ should not be the only acceptable measure of intelligence. Torrance developed the Torrance Test of Creative Thinking (TTCT). These tests have been administered to thousands across the globe and are considered a very effective tool in measuring creativity. Kim (2006) boldly defends Torrance’s research as follows:

Torrance's research into creativity as a measure of intelligence shattered the theory that IQ tests alone can measure real intelligence (Shearer, 2003). The TTCT provided a physical measure and groundwork for the idea that creative levels can be scaled and then increased through practice—a premise that was previously only conceptual (Childs, 2003). The TTCT can provide useful insights into creativity as long as the tests are used with sensitivity and good judgment by qualified professionals (p. 11).

IQ might assist in the proper assessment of academic intelligence but fails in the category of meeting the creative needs of children. Torrence used many of his original theories based on Guilford's Structure of the Intellect Model, a unique 3-D representation of his view and research on creative intelligence (Kim, 2006, p. 7). Moreover, some concepts of Guilford's divergent thinking can be directly linked to higher order and extended thinking. Webb tried to capture divergent thinking in Levels 3 and 4 of his cognitively complex Depth of Knowledge model (Webb, 2005). Although William James (1880) came long before Webb and was perhaps the first to study complex divergent thinking and "the rarity of ideational complexity," James (1880) summed up his view of creative thinking by stating the following:

Instead of thoughts of concrete things patiently following one another in a beaten track of habitual suggestions, we have the most abrupt cross-cuts and transitions from one idea to another . . . the most unheard-of combinations of elements, the subtlest associations of analogy; in a word, we seem suddenly introduced into a seething caldron of ideas . . . where partnerships can be joined or loosened in an instant, treadmill routine is unknown, and the unexpected seems the only law (p. 456).

Unlike divergent thinking, convergent thinking takes different ideas and tries to link them to a single focus (Holland, 2009, p. 284). Holland contends that divergent thinking allows ideas

to “float around without settling on one” (Holland, 2009, p. 284). This validates the complex thinking involved when one is thinking creatively. In order for the standards to fulfill their goal of setting the foundation for 21st century learners, they must incorporate the complex web of divergent thinking, allowing the students and teacher to arrive at different “unrelated possibilities before settling on one answer” (Holland, 2009, p. 285). The literature on creativity undoubtedly displays the difficulty in defining it due to its complex structures. This is very different from standards that are usually “black and white concepts, consisting of clearly stated objectives.” (Burke-Adams, 2007). Torrence (1988) is not bothered that creativity “defies a precise definition” (p. 43). Torrence is actually quite happy that there is no one-size-fits-all definition of creativity; because of the many different approaches and the endless nature of the concept itself, it is almost “infinite” (p. 43).

Researchers argue that the creation of creative thought and divergent thinking must be both original and appropriate (Amabile, 2013). Until recently, critical and creative thinking were thought to be separate entities. Critical thinking is often linked to creative thinking in the education world, but there are some important differences that must be noted. In the next section, I reveal the link between creativity, critical thinking, and cognitive complexity.

Creativity and Critical Thinking in Education

Bronson and Merryman (2010) wrote an article titled “The Creativity Crisis: For the First Time, Research Shows That American Creativity Is Declining. What Went Wrong—and How Can We Fix It?” Standards education has been the foundation in designing effective school curricula. Standards lacking creativity and critical thinking skills will lead to a curriculum with an absence of important 21st century components. There is no doubt that creativity and critical thinking have a strong connection. This is further justified by the fact that there has been no

empirical research to prove that creativity and critical thinking are not interrelated (Nickerson, 1999, p. 397). Research shows that originality is not the only source needed for a product or person to be creative; it must also be purposeful. Critical thinking, being more “down to earth, realistic, practical, staid, dependable, and conservative,” gives purpose to originality in creativity, which is more “unconstrained and innovative thinking” (Nickerson, 1999, p. 397). Trilling and Fadel (2009) contend that critical thinking and problem solving, as well as creativity and innovation, are the essential tools needed to succeed in the 21st century (pp. 96-97).

The ideas of creativity in education date back to the work of John Dewey (1916). Dewey made us aware that all students must be part of progressive reform efforts that focus on problem finding, not just problem solving, and must “not receive an inferior education based on recitation and mindless acceptance of a disjointed body of facts” (Tienken & Orlich, 2013, p. 5). Dewey believed in a democratic school system that advocated for the individual to create and solve problems that will help to move society forward. Tienken & Orlich (2013) warn of a “dual society” of students: those who are afforded the cognitive resources to succeed compared to those who are not (p. 19). Advocates of standards-based education argue that they will “level the playing field” and create balance among our unbalanced education system. However, in order to balance education and not create a “dual system,” we must understand the stark differences between autocratic standardization and democratic creative and critical thinking (Burke-Adams, 2007, p. 58). Like Dewey, Meier (2000) is an advocate for a democratic public school system, and she contends that standards “will not help contribute to a robust democratic life, or aid the most vulnerable of our fellow citizens” (p. 2). The standards simply will not allow schools to lead and teach by example or have the ability to work out varying views, “squeezing out those schools and educators that seek to show alternate possibilities and explore other paths” (p. 2).

“Creativity and critical thinking go hand in hand and help to provide different ways of making sense of a situation; after applying analytical and logical critical thinking to our problem, we can move towards the construction of a solution using our creative thinking” (Padget, 2013, p. 23). The various elements that lead to creative and critical thinking processes within education are the “learning environment, the learned curriculum, and the content curriculum” (Padget, 2013, p. 19). Padget (2013) believes that the learning environment is shaped by external physical, social, intellectual, and cultural factors. This part of critical thinking will allow students to arrive in a classroom with prerequisite skills and knowledge from their environment. Csikszentmihalyi (1996) argues that “even the most abstract mind is affected by surroundings of the body and no one is immune to the impressions on the senses from the outside” (p. 136). Research proves that socioeconomic factors and one’s environment can certainly play a vital role in depleting one’s ability to be creative (Tienken, 2010). My research acknowledges that external factors affect creative thinking, although the focus is more on the internal, foundational factors, the intended curriculum. Moreover, one study proves that regardless of one’s environment, creativity and critical thinking can still be enhanced based on the individual’s ability to connect his or her personal experiences and “habits of actions” (Csikszentmihalyi, 1996, p. 136). Padget (2013) contends that creative learning and teaching only begin once a viewpoint is accepted and relationships are established between the learner and teacher (p. 20). Padget (2013) contends that there should not be a distinction between creativity and critical thinking; they should be used interchangeably as they are “two sides of the same coin” (Padget, 2013, p. 21). Nickerson (2010) believes that critical and creative thinking cannot happen alone; they must act in unison in order to formulate a well thought out solution to a situation (p. 397).

Gardner (2000) dubbed research in creativity the “Big C” or “High Creativity” and “little c.” “Little c” has been recognized as the everyday connections that we make in order to become creative. “Little c” directly links to “Big C,” which Feldman (1994) argues is the success of something amazing and unique . . . “the kinds of things that people do to change the world” (as cited in Craft, 2005, p. 52). In essence, it seems that in order to arrive in the domain of “Big C” thinking, one has to “self-shape” one’s personal and everyday intelligence (Craft, 2005, p. 15). Weisberg (2006) adds to this by suggesting that the only way to reach high creativity is to build on the critical “foundation view” of knowledge first (p. 53). This is where the connection between creativity and critical thinking is made and where problem finding and problem solving are joined by the application of critical thinking skills to the production of our “creative thoughts” (Padgett, 2013, p. 23). Sternberg (2003) seems to differ on this, especially when it comes to standards within education. Sternberg (2003) feels there is a clear and definitive difference between creative thinking and static sequential and analytical thinking within standards (Sternberg , 2003, p. 325).

Gardner (2000) speaks about Weisberg’s “foundation view” as disciplinary knowledge and its link to creativity in respect to the different domains (as cited in Craft, 2005, p. 23). The intended curriculum is one domain of knowledge that is used by educational content specialists to prescribe a set of prerequisite rules they feel is necessary and appropriate for a subject and grade level. Some researchers argue that this standard of rules will not allow for a child to diverge from the “foundational view” into a more innovative way of thinking. The creators of the Common Core suggest just the opposite. They feel that an intended curriculum that emphasizes critical thinking and problem-solving skills will benefit education due to the fact that all students will be offered the opportunity to receive the same intended knowledge. “Whereas

standards are a black and white concept, consisting of clearly-stated objectives with aligned assessments, creativity is a difficult term to define . . . narrow definitions of creativity result in a restricted vision of the concept” (Burke-Adams, 2007, p. 58). The fundamental issue skeptics have with the Common Core is that it has never been tested. Although my study did not field test or align the standards, it can shed some light on the complex creativity embedded within them.

Creative Learning and Thinking

The goal of the standards, the intended curriculum, is to expand on the core knowledge intended for all students. The enacted curriculum, utilized by teachers, will then work to pass on this core knowledge and assist in helping students make the connections from the standards. The concern is that if the standards lack the critical foundation necessary to build upon, then the entire creative learning environment collapses. Every time we learn something new, we are making connections that can ultimately lead to creative learning. Craft (2005) asserts that “the more we are engaged in meaning making,” the more we can understand the cognitive map we are creating in our minds (p. 48). Gardner (2000) describes six ways students can be engaged in critical thinking through content standards. Gardner (2000) states that narrational, quantitative, existential/foundational, aesthetic, hands-on/experiential, and interpersonal are ways to increase creativity in schools.

Critical cognition is another piece of creative thought; and in order to enhance it and include it in our standards, we must understand it. Critical thinking and creativity both support each other in reaching high complexity levels within standards. Furthermore, critical thinking provides the bridge that links cognitive complexity to creativity.

Cognitive Complexity and Creativity

Creativity is directly linked to cognitive complexity in that it can be expressed in many unique ways and often involves many different internal and external processes (Runco, 2007, p. 13). Gamoran, Porter, Smithson, & White (1997) found that when cognitive complexity is increased in an intended and enacted curriculum, external factors such as socioeconomic status and ethnic background will play less of a role in depleting academic potential (pp. 333, 326-327). Ward, Smith, and Finke (2010) contend that “there really is something uniquely generative about human cognition” (p. 189). Research indicates that there are “similar characteristics between creativity and cognitively complex people suggesting a positive relationship between these variables” (Charlton, 1988, p. 315). Creative cognition and the theories behind it can give some validation to the creators and supporters of standardization, or at the minimum, find a balance between standardization and creativity. The positive relationship could be the simple “normative” properties of creative thought which are found not only in the scientist, artist, or musician, but in all types of students (Ward, Smith, & Finke, 2010, p.190).

As a neuroscientist, Heilman states that “all creativity involves making connections between disparate ideas that seemed to have no connection with one another” (as cited in Holland, 2009, p. 274). The language, reasoning, and understanding of ideas and their complex connection to current and past acquired knowledge allow the mind to create and innovate, hence the term *cognitive complexity*. Elaborating on the meaning of complex cognition and its link to creative thinking, Graham Wallas (1926) proposed four types of creativity: preparation, incubation, illumination, and verification. (p. 274). Mel Rhodes described another four types of creativity as the “person, the process, the product, and the press,” also known as “the four P’s of creativity” (as cited in Glaveanu, 2013, p. 69). Combining Wallas’ (1926) and Rhodes’ (1961)

four views of creativity helps to understand how the *process* is the cognitive ability to build, *prepare*, and *incubate* the *product* which will be *illuminated* and *verified* by the *press* (Glaveanu, 2013, p. 60; Wallas, 1926). Rhodes' "press" is the external social factors that will validate the original and innovative idea or product. Looking at the complex nature of standards, one could decode cues in the language of the intended curriculum that would allow the person to gain *preparation* via the standards and *incubation* via the curriculum and teaching. This in turn will lead to *illuminating* the *product* that can later be *verified* by the *press*. Wallas and Rhodes had innovative ideas and further verified the importance of prerequisite standardized training and knowledge in the connection to creative thinking. Researchers have contended that "creativity involves the ability to integrate, reorganize, or restructure existing knowledge structures" (Bakan & Charlton, 1988, p. 315). Problem finding, not necessarily problem solving and assessing the interactions, is the cognitive aspect of "creative cognition" (Chand, 1995, p. 244), although there is also evidence that innovation can take place when students are focused on specific problems.

Gardiner (1972) noted the creativity gap with individuals low in complexity, stating that they will have a more difficult time in making the necessary connections to formulate original and purposeful ideas. On the other hand, Gardiner (1972) points out that individuals high in complexity have more freedom in formulating and connecting prior knowledge, giving them the ability to connect concepts in original and purposeful ways (p. 327).

Cognitive complexity allows us to understand how the basic components of creativity work together in what some researchers call a *complex* or *syndrome* (Runco & Chand, 1995, p. 245). Cognitive complexity can be further linked to creative thinking based on the two-tier model of creative thinking below. In this model (Figure 1), three sets of creative thinking skills are described on the bottom row while contributing factors of creativity—procedural and

declarative knowledge and intrinsic and extrinsic motivation—are highlighted on the top row.
(Runco & Chand, 1995, p. 245).

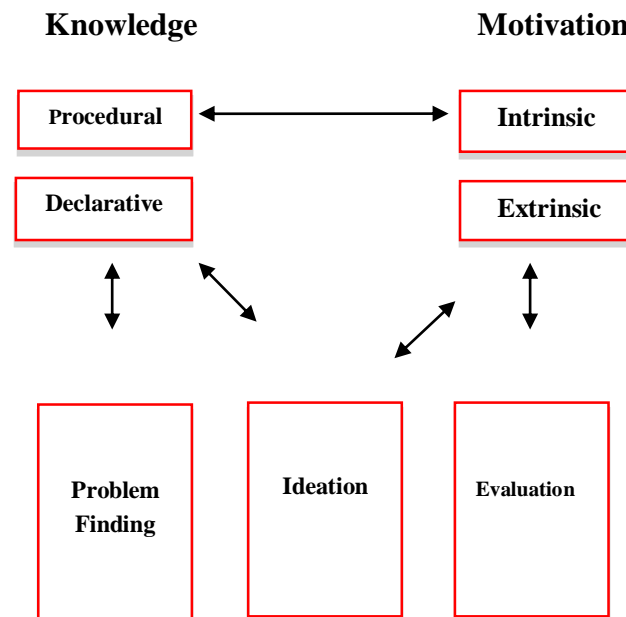


Figure 1. Two-tier model of creative thinking.

Runco and Chand (1995) emphasize the importance of knowledge and motivation within creative cognition as well as how the model can lead to “testable” predictions (p. 245). The model can further help us understand how standards within the field of education are or can be used in building creativity within schools and in students. By definition, declarative knowledge is based on facts while procedural knowledge represents the “know-how” and “dictates procedures for strategic thinking and much of creativity is strategic” (Runco et al., 1995, p. 245). Both declarative and procedural knowledge can promote creative thinking. If the “know-how” of standards are understood during their creation, then the standards, which can be linked to procedural knowledge, can potentially increase “originality and flexibility” (Runco et al., 1995, p. 245). “Explicit instruction describes strategies, defines success (or at least criteria for success),

and supplies know how” (Runco et al., 1995, p. 245). To the contrary, if the strategy, which in this study is the standards, does not work or is used repeatedly, then it can actually thwart the efforts of creative and original thought (Runco et al. 1995, p. 245).

William James (1880) stated the following:

The force of habit, the grip of convention holding down on the trivial plane we are unaware of our bondage because the bonds are invisible, their restraints acting below the level of awareness. They are the collective standards of value, codes of behavior, matrices with built in axioms which determine the rules of the game, and then and make most of us run, most of the time, in the grooves of habit reducing us to the statues of skilled automata which Behaviorism proclaims to be the only condition of man (as cited in Weisberg, 1999, p. 227).

James is building on the notion of reasoning through prior knowledge and repetition.

Levels 1 and 2 of Webb’s Depth of Knowledge focus on recall and basic application. Although basic application of material is only one step of the many complex steps that lead to creative and critical thought, we do not want it to stop there. This study revealed the distribution of cognitive demand/depth of knowledge levels within the standards. Webb’s Levels 3 and 4 are described as reaching the deeper, analytical, and more strategic/extended levels of thinking. This is where researchers argue that creativity begins. If the standards do not have the flexibility necessary, students will not be able to make the complex connections needed to get to a Webb DOK 3 and 4 level of cognition. If flexibility is not embedded into the standards, students will reach what Tindell (1997) calls a “mental block” or what Runco and Chand (1995) call “functional fixedness” (as cited in Ward, Smith, & Finke, 2010, p. 201, p. 247). Functional fixedness is “the rigidity or mental set which locks thinking so an individual cannot see

alternatives” (Runco et al., 1995, p. 247). A standard with functional fixedness would be categorized as a Level 1 recall and at most a Level 2 basic application. Standards at these levels will not have the necessary flexibility and therefore will entrap students from formulating cognitively complex creative ideas. The aim of this research was for intended and enacted curriculum writers to gain an empirical research tool in Webb’s DOK framework as a method “to recognize and overcome involuntary blocks to problem solving and creative thinking” (Ward et al., 2010, p. 202). Furthermore, assessing the standards based on cognitive complexity enabled me to see if the *preinventive procedural structures* allow for the combination of concepts and the ability to generate more complex ones (Ward et al., 2010, p. 190).

Ward et al. (2010) defend the power of the normative mind and its part in creative cognition. General or declarative knowledge allows the human mind “to accumulate knowledge and to build new ideas on what has come before that underlies our enormous generative processes and makes creativity possible” (p. 198). These statements make it all right to sometimes be “trapped by prior experiences,” as one aspect of assessing cognitive complexity is to depict which declarative and procedural knowledge will be used to increase critical thinking. Runco and Chand (2005) express that “declarative knowledge can facilitate creative thought by supplying requisite information” (p. 248). All subjects in school require some sort of prior knowledge before students are able to solve problems or strategically elaborate on questions. Standards, therefore, could be an important part of the creative process. They can be thought of as “cues” that can facilitate, but also “inhibit,” creative ideas. The one-size-fits-all standardization of our intended curriculum can deplete creative talent if the formulation focuses solely on declarative and procedural knowledge; that is, only a Webb DOK Level 1 and 2, retrieve and recall and skills and concepts, respectively (Runco & Chand, 2005, p. 248). Finke et

al. (1995) called Runco and Chand's "cues" and "declarative knowledge" "pre-inventive structures" (as cited in Ward et al., 2010, p. 190). Finke used the geneppure model (Figure 2) of creative functioning to explain how pre-inventive standards could be beneficial to problem solving, learning, and discovery (as cited in Ward et al., 2010, p. 190). Finke (2010) asserts that a specific amount of mental structures that he called pre-inventive structures, "play an important role in creative exploration and discovery" (p. 92).

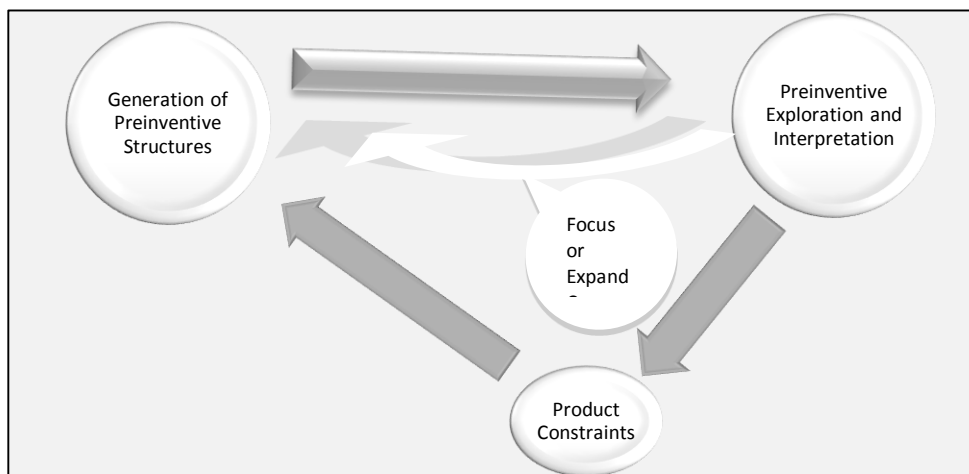


Figure 2. Geneppure model of creative functioning.

Ward et al. (2010) describe the geneppure model as follows:

The initial ideas are sometimes described as pre-inventive in the sense that they are not complete plans for some new product, tested solutions to vexing problems, or accurate answers to difficult puzzles. Rather they may be an untested proposal or even mere germ of an idea, but they hold some promise of yielding outcomes bearing the crucial birthmarks of creativity: originality and appropriateness. The geneppure model assumes that, in most cases, one would alternate between generative and exploratory processes, refining the structures according to the demands or constraints of the particular task (p. 191).

Although created long before the Common Core State Standards (2010) and the new wave of standardization, Finke's geneplore model can debunk some myths regarding standardization and its ability to prevent creative thinking in students. This is especially true when assessing the cognitively complex nature of the standards. In order for a standard to be creative and arrive at Webb's DOK Levels 3 and 4, it must contain the complexity of a Level 1 and Level 2 DOK, which are depicted in the geneplore's exploration and interpretation. Also, the geneplore's expansion of the concept component, which Webb calls extended thinking, is when creativity reaches a complex level. The generation of pre-inventive structures in the geneplore model would be the standards themselves, which were already generated for students. They would be the "internal precursors of the final, externalized products of a creative act" (Ward et al., 2010, p. 92). Based on the geneplore model, this makes assessing the standards of vital importance to a researcher searching for signs of exploration, interpretation, and expanded concepts within content.

The language and content involved in the standards using Webb's DOK levels can determine the creative cognition within the standard itself. My goal was to determine if the standards are "complex and conceptually focused or simple and relatively ambiguous, depending on the situation or the requirements of the task" (Ward et al., 2010, p. 92). Requisite knowledge as a fundamental standard in extended thinking can be further explained by Langley and Jones (1988), who state the following:

Humans possess no general creativity factor so no such component exists to be measured.

Instead, humans possess a wealth of knowledge structures indexed by concepts that a person judges important. The level of creativity that one exhibits will depend on one's

knowledge, one's indexing scheme, and the particular situation in which one finds oneself (p. 90).

As much as I have been discussing the importance of recall and retrieval in creative thinking, Langely and Jones (1988) admit that creativity involves much more (p. 90). The creative complex process does not begin until one is able to cognitively self-assess all the prior knowledge obtained from standardized work and reevaluate it, generate new ideas from it, transform it, and integrate it (Runco & Chand, 1995, p. 251; Ward et al., 1999, p. 197). If the structure of the standards does not allow for both convergent and divergent components, Ward warns that the "creators" can be "led down a path of least resistance," hitting a mental block that thwarts creative thinking (Ward et al., 2010, p. 198).

The connection between creativity and cognitive complexity as defined by Runco and Chand (1995) is "an intellectual structure which allows many interrelationships (Runco & Chand, 1995, p. 252). There is no right or wrong answer when assessing creative cognition. Its complex nature, problem construction, finding and solving enables individuals to be more "passive and selective" recipients of knowledge, instead of just passive (Runco & Chand, 1995, p. 252; Ward et al., 1999, p. 207). These statements make it clear that complex creativity cannot be standardized; it cannot "occur in a vacuum"(Runco & Chand, 1995, p. 252). Therefore, educators must understand that content objectives must be designed to allow students to be not only original, but also appropriate and that appropriateness will vary from student to student (Runco & Chand, 1995). Runco and Chand (1995) contend that "a great deal of progress has been made in the cognitive research on creativity, and educators should both take advantage of the new theories and findings and avoid some of the older practices" (p. 263). Intended and enacted curricula must encompass topics that are also unfamiliar; this will increase a student's

ability to create an original idea (Runco & Chand, 1995, p. 259). Researchers and organizations are realizing the important link between creativity and cognitive complexity for 21st century learning. In subsequent sections I highlight a few of the studies and the frameworks used to assess cognitive demand as well as my own study. Limitations from all these studies must be taken seriously, as Elkind (1980) warns that students are “cognitive aliens” and think far differently than the judges that rate assessments for creativity and cognitive demand (as cited in Runco & Chand, p. 263). Although there may be a developmental difference between adults and students, the more studies that are conducted to assess creative cognition in education, the more “creative cognition will help to legitimize the study of the creative mind,” especially within standards (Ward et al., 1999, p. 209). Tanner and Allen (2002) believe that “standards need to endorse an approach to learning that is student-centered, rooted in engaging students’ natural learning curiosity, and making education relevant to the learning and being of everyday living” (2002, p. 97). Others believe that current standardization efforts will align to the average, undermining the states that already had quality standards (Burke, 2012).

Standardization, Accountability and Testing: A National Intended Curriculum Cardinal Principles of Secondary Education

A Nation at Risk (1983) was one of many landmark reports that started a tidal wave of reform, fear, reinvention, standardization, failed policies, and accountability (Tienken & Orlich, 2023, p. 28). Since then, teachers and educational leaders have been held accountable based on how well students perform on standardized tests. Experienced and qualified teachers are at the edge of their seats waiting for student scores to be posted. Some researchers have claimed that these rash reform efforts have hurt students rather than helped them academically. Niebling (2012) argues that even though we have written, revised, and implemented new and “high

quality” standards in order to increase student achievement, the results have yet to prove that the “achievement gap,” especially when factoring in socioeconomic status, is decreasing (Niebling, 2012, p. 14).

A Nation at Risk is perhaps one of the more recent reports that demonstrate the pressure placed on schools and on policy makers to create rigorous, college ready standards, although there were many previous landmark studies that helped shape this concern. The standards did not arise from a “simple mistake.” Let us refer to an old study, the Report of the Committee of Ten on Secondary School Studies (1893). The “Committee of Ten” study, although initially designed to follow a democratic Dewey approach, was far from that. (Tienken & Orlich, 2013, p. 6). Similar to current reform movements, their advice was to revise the high school curriculum so that students can be better prepared to succeed and get accepted into a post-secondary education program. This philosophy narrowed the curriculum to a prescribed set of courses and eliminated electives that allowed students to think, grow, and approach problems with many different views (Tienken & Orlich, 2013, p. 6). Following this unsuccessful policy, the *Cardinal Principles of Secondary Education* (1918) report was released. The principles advocated for a more hands-on, democratic, experiential, and problem-finding curriculum. Tienken and Orlich (2013) claim that the *Cardinal Principles of Secondary Education* is “education’s Declaration of Independence” (p. 9). Whether directly or indirectly, the principles afforded the opportunity for students to be creative and think critically. Creativity is an essential component of entrepreneurship, problem finding, and problem solving (Burke-Adams, 2007, p. 59). The experiential learning embedded into the principles provided students with the tools necessary to “practice nonconventional models of thinking that enhance motivation” (Burke-Adams, 2007, p. 59). The U.S. Department of Education says that “entrepreneurship education as a building block for a well-rounded

education not only promises to make school rigorous, relevant, and engaging; but it creates the possibility for unleashing and cultivating creative energies and talents among students” (as cited in Zhao, 2012).

A National Intended Curriculum

In a study conducted by Porter, McMaken, Hwang, & Yang (2011), researchers argue that supporters of a new United States intended curriculum were ill advised on the push to adopt a new set of standards. Intended curriculum designed to fit the same cognitive development of every single student in every single walk of life from every single ethnic and social background has been forced onto schools. Some claim this “forced habit” has created “automatons” or as James (1880) called them, “statues of skilled automata” that will not be able to contribute or compete in an increasingly complex society (as cited in Weisberg, 1999, p. 227; Tienken & Orlich, 2013, p. 109). Researchers claim that we are programming students to all think the same, when in fact we know that cognitive development is different for every child. Can a “standards-based education and creativity coexist?” (Burke-Adams, 2007, p. 58). If they cannot, perhaps Meier (2000) minces no words about what could happen:

Educators from the progressive tradition are often accused of “experimenting” on kids. But never in the history of the nation have progressives proposed an experiment so drastic, vast and potentially serious in its real-life impact on millions of young people. If the consequences are other than those its supporters hope for, the hit to the nation’s educational system and the youngsters involved—maybe even our economy—will be large and hard to undo (p. 10).

Education policy makers worldwide are racing against the clock in creating academic curricula that is engaging, creative, and analytical in nature. These are the same creative

energies that Aiken's Eight-Year Study talked about over 70 years ago. It seems that Aiken's (1942) study was either ignored or we are finally feeling the effects of it seven decades later, creating policies that mirror the failed policies of Aiken's time. Aiken's study provided us with empirical evidence on the lack of creative energies students developed within high school classrooms, focusing on five principles that are essential in creative cognitive development: (1) strong emphasis on the student, (2) their personal experiences, (3) their different developmental styles, (4) problem solving and making prior knowledge connections, and (5) ability to approach problems through many different lenses (Aiken, 1942). Padgett (2013) supports Aiken's study with his belief that what and how students learn, along with the intended and enacted curriculum, all play an important role in a democratic and creative curriculum (p. 19).

Standardization

"The hamster wheel of educational reform continued to turn" until 1983 when policy makers put out a bombshell report called *A Nation at Risk: The Imperative for Educational Reform*. This report stated our economy was in dire need of repair and it was the public school system that had caused its downfall (Tienken & Orlich, 2013, p. 14, Meier, 2000, p. 6). Similar to reform movements echoed in the states today, teachers, principals, and anyone else in education were targeted and held accountable as one of the main sources of our failing school system (Meier, 2000, p. 6). These fear tactics have had their place in history. We saw a similar scare instilled into American education when the Soviets launched *Sputnik* and beat us in the pursuit of our exosphere (Tienken & Orlich, 2013, p. 24). This was potentially the first hint at nationalizing and stripping the constitutional right of states to control their own education curriculum. The second hint was privatizing public education so that, as is true today, schools begin to become more like businesses instead of institutions that focus on teaching students how

to become entrepreneurs and run their own business (Meier, 2000, p. 9). This has “dominated the standards-based reform movement” (Meier, 2000, p. 10). More than a decade after the report was released, the American economy, “productivity of our workforce,” and even our public education system were ranked amongst the best in the world (Meier, 2000, p.10). Critics argue that the real crisis with standardization is that it will in fact create the “dual system” and this in turn will only perpetuate the real crisis we have: cultivating and empowering the diverse learner. When students are subjected to a one frame convergent type of thinking, some will make it, many will not, and few will be creative. Our schools seem to be turning into assembly lines of information and knowledge; and teachers and school administrators fear losing their careers based on potentially flawed assessment scores, instead of addressing the real concerns of engaging students in critical and creative thinking (Meier, 2000, p. 12). Tienken & Orlich (2013) contend that standardization with the new wave of Common Core State Standards is punishing all our students based on the failed policies of a few, a term they refer to as “collective punishment” (p. 39). Sternberg (2003) argues that schools reward students that are able to possess recall and recitation skills but should be “nurturing and rewarding rather than ignoring or even punishing students who are high in creative or practical skills” (Sternberg, 2003, p. 325).

No Child Left Behind

Since 2001, the No Child Left Behind Act has ruled school systems in the United States with an iron fist. It was meant to hold schools accountable and close the achievement gap. Critics argue that it did little to promote a positive and democratic education system and was meant to do nothing more than “cripple the system” so that private companies, as is true today, can rule public education (Tienken & Orlich, 2013, p. 53, 54). Guisbond, Neill, and Schaeffer (2012) conducted a 10-year study dubbed NCLB’s Lost Decade for Educational Progress based

on NAEP assessment results. Guisbond et al. (2012) highlighted three key findings from their study:

(1) NCLB has severely damaged educational quality and equity, with its narrowing and limiting effects falling most severely on the poor, (2) NCLB failed to significantly increase average academic performance and significantly narrow achievement gaps, and (3) So-called "reforms," such as the Obama Administration's waivers and the Senate Education Committee's Elementary and Secondary Education Act (ESEA) reauthorization bill, fail to address many of NCLB's fundamental flaws and in some cases will intensify them. These proposals will extend a "lost decade for U.S. schools" (p. 2).

Policy makers continue to claim that we are lagging behind other nations based on international results such as the PISA and TIMMS because we fail to implement the proactive policies of those nations. Evers (2001) argues that because standards and accountability efforts evolved through politicians and not educators, the outcomes have been negative for many states within the United States. Evers states that setting standards seems to be a simple solution: set the standards, enforce accountability mandates; and then when they don't work and you have invested heavily in them, withdraw from them and try again (Evers, 2001, p. 246).

Common Core, Testing, and Accountability

Advocates of the current standards movement argue that structured objectives clarify student questions instead of just vaguely understanding a topic (Sandholtz, 2004). Finn (2006) boldly voiced his opinion of the current standards reform movement by stating, "Let me be frank: With a handful of laudable exceptions, the academic standards in use in most states today range from mediocre to dreadful" (p. 1). Although it may seem that Finn is against standards, his motive behind that statement was to promote the Common Core. A recommendation Finn gave

to winning what he dubs the Common Core “battle” is to join in the “battle.” Finn’s principal argument lay on the notion of transparency. Finn (2006) asserts that a one-size-fits-all assessment scheme would level the playing field for all, and parents and the public “would know how their own schools are doing and could decide for themselves whether to (a) leave things be, (b) demand a makeover, or (c) move their kids to other schools” (Finn, 2012). Finn feels this type of transparency can free states from national mandates on items such as spending and evaluating teachers. Moreover, it will allow for schools to “run themselves” and “decide for themselves what to teach on top of standards” (Finn, 2012). Finn adds that support of the Common Core will ultimately and automatically create a “demand for outstanding school leadership” (Finn, 2012). Research proves that schools that want to reshape and revolutionize current curricula must not rely only on a one-size-fits-all essentialist philosophy or they will fail to meet the readiness of each child (Tanner, 2007). Finn argues that schools will have greater autonomy by bowing down to the Common Core. This is in contrast to the second major proposition of the landmark Eight-Year Study, which states that schools will gain trust and freedom by breaking free from standardized prescriptions (Aiken, 1942, p. 124). Finn states that advocating for the Common Core will allow more flexibility to teach “art/music, STEM, technical vocational education, history, and literature” (Finn, 2012). Aiken’s study tells us that students exposed to an inflexible regimen of classes will “seldom release or develop their creative energies,” which are important in the arts/music, STEM, history, and literature (Aiken, 1942, p. 6). Moreover, a prescribed “inequitable” solution to curriculum has proven that “students would be so busy ‘doing assignments,’ meeting demands imposed on them that they had little time for anything else” (Aiken, 1942, p. 6).

Tanner and Tanner (2007) suggest that using test scores as the indication of school performance as well as assessing teachers and publicizing this information puts extreme pressure on teachers (p. 27). It seems as if Finn is more concerned about keeping the status quo as opposed to keeping moral equity and quality in education. Tienken (2011) contends that the Common Core is a one-size-fits-all approach that does not allow students to reflect on prior knowledge. The Eight-Year Study confirmed and Zhao reaffirmed the answer to the question of a common standard, “The only standard is there should be no standardization” (Zhao, personal communication, July 16, 2012).

If Finn had at least connected some of his arguments to one piece of classic literature on common assessments for all, he might have had a semi-credible case for his conservative “one-size-fits-all” education. Finn argues that the Common Core is the way to improve local control, but Aiken’s (1942) “Eight-Year Study already demonstrated that curriculum can be an entirely locally developed project and still produce better results than traditional curricular programs” (Tienken, 2011, p.14).

Finn adds very little evidence on how his essentialist view on education will help the cognitive development of students. The historical significance of Dewey’s experiential learning is absent in Finn’s argument of Common Core for all (Tanner, 2007). Understanding current and past literature on curriculum theory and policy will help to improve and balance some of the historical and fundamental deficiencies of our current “school curriculum, which has been far removed from the real concerns of youth” (Aiken, 1942). There are claims that the creators of the CCSS lack empirical data in determining whether or not they truly are different than the NJCCCS (Porter et al., 2011). Furthermore, critics question if the CCSS will give New Jersey students the competitive creative edge needed to succeed and compete globally. My study sought

to prove or disprove whether the CCSS are really “stuck in a curricular time warp” (Tienken, 2011, p. 5). My study sought to use Webb’s Depth of Knowledge levels to assess the standards, not students. Assessing standards allows us to recognize and understand at the onset whether or not a nationalized intended curriculum will prove beneficial for New Jersey students. Many studies have been conducted in assessing creativity, but none have attempted to measure creativity based on the cognitively complex nature of our state and national benchmark standards. Injecting complex and deeper learning into the intended curriculum can yield positive results for everything that follows: enacted curriculum, creativity and critical thinking in teaching, inquiry and problem-based learning, and 21st century assessments.

Liberal Arts at the College Level/Tradition of Liberal Arts

Advocates of the current Common Core movement are having difficulty explaining how the Common Core is truly preparing our high school students to be college and career ready when confronted by scholars such as Dr. Sandra Stotsky and Dr. James Milgram, the ELA and Mathematics gurus on the Common Core validation committee. Dr. Stotsky, a professor emeritus from the University of Arkansas and perhaps the leading educator on educational standards and teacher licensure assessments, has been a strong voice in ensuring states know the truth behind the standards (Berry, 2014). Stotsky claims that the ELA CCSS just do not add up to the 21st century college and career readiness initiative that the creators claim them to be. Moore (2013) argues that the creation of the Common Core was never to “instruct, educate, enlighten, and improve the minds and souls of young people by teaching them the great stories of our Western and American tradition” (p. 8). Although the ELA standards do show promise in the reading levels from K-12, the rigor seems to be absent from the high school standards (Stotsky, 2012). Stotsky, who was part of the Common Core validation committee, told *Breitbart News*,

“We are a very naive people” (Berry, 2014). “Everyone was willing to believe that the Common Core standards are ‘rigorous,’ ‘competitive,’ ‘internationally benchmarked,’ and ‘research-based.’ They are not.” (Berry, 2014). Stotsky argues that the content rigor and complexity is absent from the ELA standards. Informational reading is stressed throughout the CC ELA standards. Bauerlein and Stotsky (2012) claim that the current ELA CC standards will in fact decrease college and career readiness by focusing on “literary nonfiction or informational reading” instead of “complex literary texts and literary traditions.” Moore (2013) argues that the new Common Core ELA standards “sound high but aim low” (p. 67). School officials have been “misguided” in their understanding of the ELA standards. Bauerlein and Stotsky (2012) claim that no research exists to support the division of Reading and Reading Literature standards (p. 1). Moore contends that the creators of the Common Core have no idea of how to truly prepare students to be college and career ready (p. 27). He goes on to back Bauerlein and Stotsky’s assertion that no research exists that colleges have asked for students to read more “informational as opposed to literacy texts” (Moore, 2013, p. 27).

Emphasis on literature and literary study is an “academic necessity in order to prepare students to be college and career ready . . . at no time did any college recommend a reduction in the literature taught in the high school English class or an increase in other types of readings” (Bauerlein & Stotsky, 2012, p. 4). There has been a large disconnect between what literature is expected to be understood at the college level and how high schools are preparing students for the rigor of college English, leading to a decrease in student performance and an explosion of English remediation at the college level, including an increase in first-year drop-outs. The ELA CCSS were the final straw for the downward trend of reading texts in the last 50 years, leading to a decrease in “coherence and rigor of literature/reading curriculum” (p. 5). Great literature is

essential in enabling us to “understand human beings and to sympathize with them” (Moore, 2013, p. 50). While a history course is also an essential part of a school curriculum, it does not allow for creativity and imagination to flourish quite as great literature does. (Moore, 2013, p. 51).

Massachusetts’ previous standards, considered among the most rigorous in the United States, led to a historically rich curriculum in literary studies that made Massachusetts the leading state in education and national assessment results year after year. Moore (2013) states that Massachusetts is the only state that had standards that allowed educators to know what they had to teach and “how great literature ought to be taught” (p. 65). Massachusetts’ English teachers were content and happy with the progress of their students, as were the colleges to which these students were being accepted, showing continually positive results on their AP English tests (Bauerlein & Stotsky, 2012, p. 5). “At no point did the state’s English teachers suggest that a reduction in literary study or an increase in informational reading in the high school English class would make students better prepared for post-secondary education” (Bauerlein & Stotsky, 2012, p. 5). An ACT study found that Grades 9-12 students that spend more time on complex readings as opposed to watered down informational texts do better in college, making “college readiness dependent on skills developed through complex texts” (Bauerlein & Stotsky, 2012, p. 6). “If complexity contains so much literariness, why reduce literary reading?” (Bauerlein & Stotsky, 2012, p. 6). Moore (2013) argues that the “text complexity” so often written throughout the standards is not complex at all. In his book *The Story Killers: A Common-Sense Case against the Common Core*, Moore gives detailed examples of the types of complex books Common Core recommends students to read which are years below grade level and not so “complex” (p. 71).

Bauerlein and Stotsky (2012) argue that the English curriculum has narrowed dramatically since the adoption of the Common Core, mainly because the English standards were not approved or created by English teachers or humanities experts. “The architects have provided no rationale even for organizing a 50/50 division of reading standards in Grades 6-12 between informational text and literature, never mind a heavy emphasis on literary nonfiction” (Bauerlein & Stotsky, 2012, p. 9). NAEP, in its explanation of reading and literature assessments, explains that all stakeholders, including parents and the community, are responsible for a child’s reading skills; but CCSS still uses NAEP’s percentages to influence the percentage of reading informational and reading literature standards. Note that NAEP’s percentages are not, and never were, backed by any empirically based research (Stotsky, 2012, p. 10). Moore (2013) questions whether reading more informational—that is, daily newspapers—is a better choice than reading the “greatest things that have ever been written” (p. 56).

Critics argue that once PARCC test results begin to come in, English teachers will be forced to decrease literary teaching and increase informational reading, even though, at the high school level, they are more equipped to teach literature, not informational reading (Stotsky, 2012, p. 7). Furthermore, current PARCC ELA examples do not have any questions that test students’ literary-historical knowledge (p. 18). Stotsky argues that PARCC’s answer to why there are no specific criteria for the questions in each grade level of the PARCC is that, unlike the math standards, the creators of the PARCC “imply that Common Core’s ELA standards have none” (p. 18). Stotsky contends that literary texts, not informational readings as described in the ELA Grades 9-12 CCSS, will prepare students better for college. This is quite the opposite of what is proposed in the ELA CCSS. Stotsky’s argument comes from the complexities found in classic literary texts, such as their “vocabulary, structure, style, ambiguity, point of view,

figurative language, and irony” (Stotsky, 2012, p. 7). No research to date states that a high school curriculum that is rich in informational reading prepares students better for college than the traditional curriculum which focused on literature. (Bauerlein & Stotsky, 2012, p. 7; Moore, 2013). Moore also points to the high interest students have in one another’s lives, which sometimes leads to conflict. Moore (2013) sees this as embedded in our history and culture, stating, “The more interesting the person in question . . . the more interest he generates in others wanting to know his story” and that is basically what great literature is—great stories, about interesting people, written by “accomplished storytellers” (p. 49).

Supporters of the College and Career Readiness Anchor standards advocate for a high school English curriculum rich with classical literature readings, stating that students must master complex literature that “extends across genres, cultures, and centuries” (NGA & CCSSO, 2010, p. 35). These readings include, but are not limited to, influential U.S. documents, classic American and British literature, and over “300+ years of social and historical context” (Stotsky, 2012, p. 11). In order to successfully master the text complexity within the breadth and depth of this literature, students must master the “foundational and classic nature” of these readings (Stotsky, 2012, p. 11). Although the ELA CCSS specify that students should be exposed to historical literature, they do not provide specifics into the exact readings and passages, as previous states’ standards provided (Moore, 2013, p. 11). When investigating the standards myself, I found that the standards and strands for elementary ELA all the way to high school ELA were very similar. Moore argues that the standards are nothing more than “a cut and paste operation” (p. 60). The standards, according to Moore (2013), leave many readers uncertain of their true meaning and Stotsky (2012) disputes that if teachers are left to decide, at their

discretion, what CCSS means by “foundational” and “classic literature,” the validity, reliability, and rigor of the standards between schools will decrease (p. 12).

An important component of cognitive complexity and creativity is to be able to make important connections between current and prior knowledge. Literary readings within a high school curriculum should follow a strict chronological structure, where teachers are able to present students with texts from Old English readings such as *Beowulf* to modern texts after the Renaissance Period. Although the CCSS asks teachers to identify readings across centuries, it does not specify the chronological order that will allow teachers to scaffold the information and students to make the important creative connections and interpretations necessary (Stotsky, 2012, p. 13). “On grounds of influence alone, the absence of British literature from the Common Core is a serious deficiency” (Stotsky, 2012, p. 13). British literature is still heavy in college courses; thus, to say that the ELA CCSS will make students college and career ready could be a misstatement. “British literature forms the literary heritage of our own language” and the “study of human conversation” (Stotsky, 2012, p. 1; Moore, 2013, p. 52). An important skill in today’s economy is the ability to communicate effectively. Moore argues that if business leaders are advocating for more communication skills amongst our graduates, then why is there a decrease in the amount of literature, which “specializes in the art of conversation” (Moore, 2013, p. 53). Moore (2013) contends that the purpose of the Common Core is “to erase any remnant of traditional learning in the English classes of our public schools” (p. 14). “Common Core downplays the historical understanding of language, a capacity that advances students’ ability to handle certain kinds of text complexity” (Bauerlein & Stotsky, 2012, p. 13). Stotsky (2012) contends that, even if teachers did interpret the literary-historical standards in classical and American and British literature, the 50/50 divide between informational and literary just is not

enough (p. 13). Stotsky recommends that teachers embed and use “foundational/classical” readings and other “non-fiction, non-poetic, and non-dramatic classics” as part of the 50% informational readings outlined in the Common Core. The one potential problem local curriculum writers and teachers may have with this is if it does not align to the PARCC or Smarter Balanced state assessments. If standardized tests are to mimic the CCSS and the CCSS do not specify or include important readings that will prepare students to be better equipped for college and careers, then it will simply become a writing game to see what the results and specific information will be on the assessments that students will need to master. Teachers and schools will not know this until the end of the first official run of the tests after the 2014-2015 school year.

The term *complexity* is used throughout the Common Core ELA standards, although Stotsky argues that it refers more to a student’s “life experiences” than to their “historical understanding,” therefore removing the rigor and challenges within texts to which students will be exposed (p. 14). Moore (2013) challenges us to compare two documents: the Common Core English Standards and an essay written by Benjamin Franklin called “Proposal Relating to the Education of Youth in Pennsylvania” (p. 33). After reading the two documents, readers can clearly see the point Moore was trying to make regarding his view of poorly written national standards. Although the intent of the Common Core is to promote a curriculum that is rich in historical literacy, the vagueness in the language can deter teachers from implementing it into their lessons. This deficiency can pose problems for students when they are exposed to complex historical and classical texts in college. Stotsky (2012) warns that there is no penalty, according to the current Common Core, for teachers who do not implement anything more than one “Shakespeare play” (p. 15). Stotsky recommends that state education agencies should add more

focused literary standards to the existing Common Core and points to their previous intended curriculum for guidance stating that states should “feel free to copy from states that were judged to have literary standards superior to Common Core’s” (p. 16). Stotsky also recommends to “go international” to find more rigorous standards. For example, she points to Canada’s literary standards, which she claims are far superior to the Common Core and uses this example to inform the reader once again that the Common Core was never internationally benchmarked as originally marketed (p. 17). English departments must supplement their Common Core curriculum with “American and British literary/cultural history and the development of the English language” (Stotsky, 2012, p. 19). Stotsky warns that a high focus on informational reading will diminish 21st century skills, such as analytical thinking, due to their focus on more “topical/political” readings as opposed to more complex college level readings (p. 19). “Common Core lays out what students should be able to do, not what they should know” (Stotsky, 2012, p. 20). Moore (2013) fears that not only will students not be college and career ready, but that professors will begin to conform to the poor standards, eventually dumbing down their own curriculum; ergo, we will have a new generation of students that “will continue to learn nothing” (p. 66).

An Assessment of Cognitive Demand Frameworks

Runco (2007) argues that some may think that creativity is a simple phenomenon, although it certainly has its share of complexity. The complexity of creativity has been researched in varying fields, ranging from the behavioral and social sciences to the business and art world (Boden, 1999; Runco, 2007). Although there is no standardized approach, there are frameworks and taxonomies used today to assess and align cognitive demand, higher order thinking, and deeper levels of learning with state assessments, school curricula, and content

resources. *A Nation at Risk* set the standards for standardization, highlighting the weaknesses in U.S. student scores as compared to other countries. National tests such as the *Second International Mathematics Study* (SIMS) and the *Third International Mathematics Study* (TIMSS) have consistently revealed national differences in the content, depth, and breadth of instruction, and the relationship of this instruction to student achievement (Niebling, 2012, p. 1). Gamoran, Porter, Smithson, & White (1997) indicated that the better alignment between the intended and enacted curriculum, the better students performed on assessments (p. 333). Gamoran et al.'s study is similar to the present study in that it does not take into account a student's social class or background. The exclusion of socioeconomic status adds validity to studies such as the present one in that it emphasizes how a poorly or well written intended curriculum could lead to students' success or failure, excluding external factors such as home life. (Gamoran, Porter, Smithson, & White, 1997).

Common Core State Standards were adopted by 48 states in 2010. The Common Core will be the foundation of new K-12 state and national assessments. PARCC and Smarter Balanced claim their assessments will be fully aligned with the CCSS and contain college and career readiness questions. Many researchers have attempted to align test items or curricula with a cognitive framework (i.e., Bloom's Revised Taxonomy (2001), Webb's DOK (1997), Hess's Cognitive Demand Matrix (2009)). Most tools used to assess cognitive demand, such as Bloom's Taxonomy (2001) and Hess's Cognitive Demand Matrix (2009), were used to assess test items and the enacted curricula, not so much the intended curriculum, although a few studies (Niebling, 2012; FSU, 2012; Porter, McMaken, & Hwang, 2011) did in fact use the intended curriculum to align standards with levels of cognitive complexity. Both Iowa, using Niebling's study (2012), and Florida, using Florida State University's CPALMS study (2012), have recently

coded the versions of the Common Core standards in ELA and Math using Webb's (1997) Depth of Knowledge. In addition, Porter, McMaken, & Hwang (2011) assessed the Common Core based on Blank, Porter, & Smithson's (2001) Surveys of Enacted Curriculum (SEC).

In order to choose the framework that would work best for this study, I studied an array of cognitive frameworks developed to assess cognitive demand and critical, higher, and deeper levels of thinking. The following are some of the frameworks studied followed by a detailed description of Webb's Depth of Knowledge, the theoretical framework used for this study.

The National Assessment of Education Progress (NAEP)

The National Assessment of Education Progress (NAEP) used cognitive complexity to assess content within Mathematics. In addition, NAEP created a similar framework for reading, although I only reviewed its mathematics matrix, as its methods and content closely match this study. The initial goal of NAEP's cognitive complexity framework was to ensure that course content as well as differentiated ways of completing the content on assessments was satisfied. NAEP's framework was of interest due to its focus on the cognitive demand of specific items as opposed to enacted curricula. "The NAEP frameworks provide the theoretical basis for the assessments and describe the types of questions that should be included and how they should be designed and scored" (NAEP, 2011). Although NAEP updated its framework since 2005, the updates were only for the sample questions, not the actual model. "Mathematical complexity deals with *what* the students are asked to do in a task. It does not take into account *how* they might undertake it" (NAEP, 2010, p. 37). NAEP (2013) specifies that the framework was not intended, nor should it be used, to assess curriculum. The NAEP framework for mathematics classifies items on tests based on the content and cognitive complexity. Similar to many other forms of complex measures of cognition, the NAEP framework is a hierarchical model that

ranges from low to high complexity. Dimensions of creative cognition such as conceptual understanding, procedural knowledge, problem solving, reasoning, connections, and communication are all components of the NAEP model. The following descriptive levels were retrieved from the NAEP (2005) Mathematics framework, which highlights the NAEP complexity levels as follows:

Low complexity.

This category relies heavily on the recall and recognition of previously learned concepts and principles. Items typically specify what the student is to do, which is often to carry out some procedure that can be performed mechanically. The student is not expected to come up with an original method or solution. The following are some, but not all, of the demands that items in the low-complexity category might make:

- Recall or recognize a fact, term, or property.
- Recognize an example of a concept.
- Compute a sum, difference, product, or quotient.
- Recognize an equivalent representation.
- Perform a specified procedure.
- Evaluate an expression in an equation or formula for a given variable.
- Solve a one-step word problem.
- Draw or measure simple geometric figures.
- Retrieve information from a graph, table, or figure.

Moderate complexity.

Items in the moderate-complexity category involve more flexibility of thinking and choice among alternatives than do those in the low-complexity category. They require a response

that goes beyond the habitual, is not specified, and usually has more than a single step. The student is expected to decide what to do, using informal methods of reasoning and problem-solving strategies, and to bring together skill and knowledge from various domains. The following illustrate some of the demands that items of moderate complexity might make:

- Represent a situation mathematically in more than one way.
- Select and use different representations, depending on situation and purpose.
- Solve a word problem requiring multiple steps.
- Compare figures or statements.
- Provide a justification for steps in a solution process.
- Interpret a visual representation.
- Extend a pattern.
- Retrieve information from a graph, table, or figure and use it to solve a problem requiring multiple steps.
- Formulate a routine problem, given data and conditions.
- Interpret a simple argument

High complexity.

High-complexity items make heavy demands on students, who must engage in more abstract reasoning, planning, analysis, judgment, and creative thought. A satisfactory response to the item requires that the student think in abstract and sophisticated ways. Items at the level of high complexity may ask the student to do any of the following:

- Describe how different representations can be used for different purposes.
- Perform a procedure having multiple steps and multiple decision points.
- Analyze similarities and differences between procedures and concepts.

- Generalize a pattern.
- Formulate an original problem, give a situation.
- Solve a novel problem.
- Solve a problem in more than one way.
- Explain and justify a solution to a problem.
- Describe, compare, and contrast solution methods.
- Formulate a mathematical model for a complex situation.
- Analyze the assumptions made in a mathematical model.
- Analyze or produce a deductive argument.
- Provide a mathematical justification.

In this study NAEP (2013) focused specifically on the cognitive demand of questions within their tests. NAEP's (2013) low, medium, and high levels of complexity were used to assess questions within assessments, although they make it clear that the order does not imply the developmental levels or ways math should be learned or taught. Although there was an initial attraction to this framework for my study based on only three levels of complexity and its use within content, it still did not meet the deeper levels of learning and assessment of creativity I needed to code the standards. Furthermore, it was not a widely accepted tool to use to assess standards; therefore, NAEP's framework was not used for my study.

Bloom's Original Taxonomy (Bloom 1)

Benjamin S. Bloom (1956) created one of the first taxonomies of cognitive demand for the fundamental purpose of describing the learning process among students. Bloom's framework follows a hierarchical system where learning is built on prior acquired knowledge. Bloom's Taxonomy of Educational Objectives included knowledge, comprehension, application, analysis,

synthesis, and evaluation. A detailed description of the classification of cognitive domains is as follows:

Knowledge is defined as the remembering of previously learned material. Knowledge represents the lowest level of learning outcomes in the cognitive domain. It is usually associated with rote memorization and recall of specific facts.

Comprehension refers to the ability to grasp the meaning of material. These learning outcomes go one step beyond the simple remembering of material and represent the lowest level of understanding. This level of learning involves explaining, summarizing, defending, or predicting.

Application refers to the ability to use learned material in new and concrete situations. Learning outcomes in this area require a higher level of understanding than those under comprehension. This level of cognitive learning involves application, demonstration, manipulation, and relating.

Analysis means the ability to break down material into its component parts so that its organizational structure may be understood. Learning outcomes here represent a higher intellectual level than comprehension and application because they require an understanding of both the content and the structural form of the material. This level of cognitive learning involves differentiating, relating, and distinguishing.

Synthesis refers to the ability to put parts together to form a new whole. Learning outcomes in this area stress creative behaviors, with major emphasis on the formulation of new patterns of structures. This level of cognitive learning involves creating, composing, designing, and revising.

Evaluation is concerned with the ability to judge the value of material (statement, novel, poem, research report) for a given purpose. Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all of the other categories, plus conscious value judgments based on clearly defined criteria.

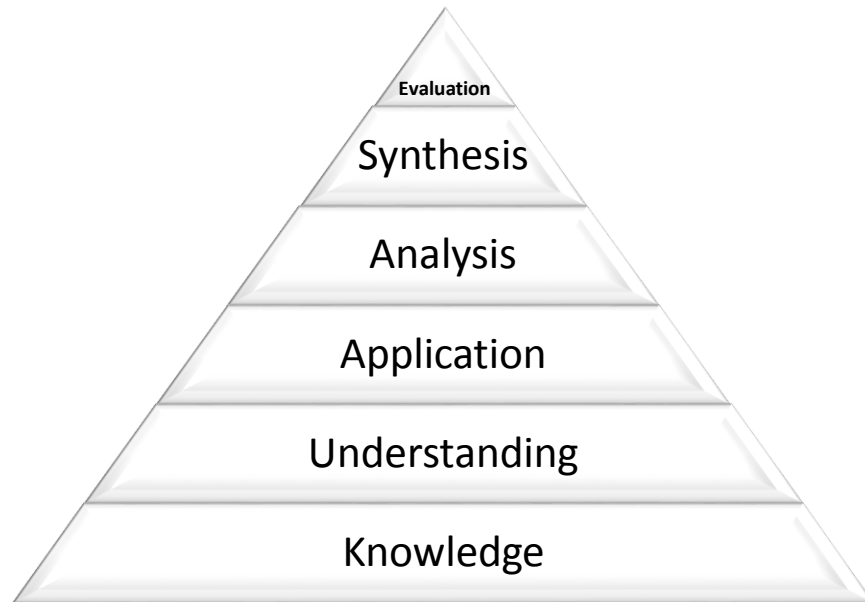


Figure 3. Bloom's original taxonomy.

Addressing the concern of cognitive processes and linking it to education and student learning, Bloom's original taxonomy has been used to design lesson plans and alignment studies over the past several decades (Evans, 1999). Bloom described the importance of organizing content using a hierarchy of needs so that students can make connections with the prior knowledge that they have already gained (Bhattacharya, 2002; Jonassen, Peck, & Wilson, 1999). Although innovative in its approach, the original taxonomy is not far from criticism; it is one-dimensional, it is too vague, and it lacks creativity and critical thinking (Ennis, 1985). Ennis (1985) contends that Bloom's original taxonomy was never intended to provide guidance on how and what to teach; its purpose was more to classify what and how things are being taught (p. 47).

These statements make it clear that, although a respectable framework, Bloom's original taxonomy would not adequately assess the deeper levels of complex and creative learning within standards because its intent was to be used as a classifying system of educational objectives rather than assessing them for cognitive complexity.

Bloom's Revised Taxonomy (Bloom 2)

Peter Anderson & David Krathwohl (2001) created a revised version of Bloom's original taxonomy that takes a two-dimensional approach. Researchers contended that Bloom's revised taxonomy allowed for more differentiation, modeling, and independent teaching. (Airasian & Miranda, 2002; Anderson et al., 2001; Byrd, 2002). Pickard (2007) asserts that the taxonomy, "in spite of being available since 2001," is being used more by curriculum writers and test creators today than ever before (p. 53). The two-dimensional model includes both knowledge and cognitive aspects of learning. The main difference between Bloom's original taxonomy and Bloom's revised taxonomy is the ability to create critical thinking. Language within the revised taxonomy was changed from simple nouns to verbs. Krathwohl (2002) explained Bloom's revised taxonomy by stating the following:

This brought uni-dimensionality to the framework at the cost of a *Knowledge* category that was dual in nature and thus different from the other taxonomic categories. This anomaly was eliminated in the revised taxonomy by allowing these two aspects, the noun and verb, to form separate dimensions, the noun providing the basis for the Knowledge dimension and the verb forming the basis for the Cognitive Process dimension.

Due to this study's specific interest in cognitive complexity models, the following cognitive domain of Bloom's revised taxonomy, as retrieved from Krathwohl (2002), was the only section considered for my study:

Structure of the Cognitive Process–Dimension of the Revised Taxonomy

Remembering - Retrieving relevant knowledge from long-term memory.

This cognitive domain level involves simple Recognizing and Recalling of facts.

Understanding - Determining the meaning of instructional messages, including oral, written, and graphic communication. This cognitive domain level involves Interpreting, Classifying and Explaining.

Applying - Carrying out or using a procedure in a given situation. This cognitive domain level involves Executing and Implementing.

Analyzing - Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose. This cognitive domain level involves Differentiating, Organizing, and Attributing.

Evaluating - Making judgments based on criteria and standards. This cognitive domain level involves Checking and Critiquing.

Creating - Putting elements together to form a novel, coherent whole or make an original product. This cognitive domain level involves Generating, Planning, and Producing.

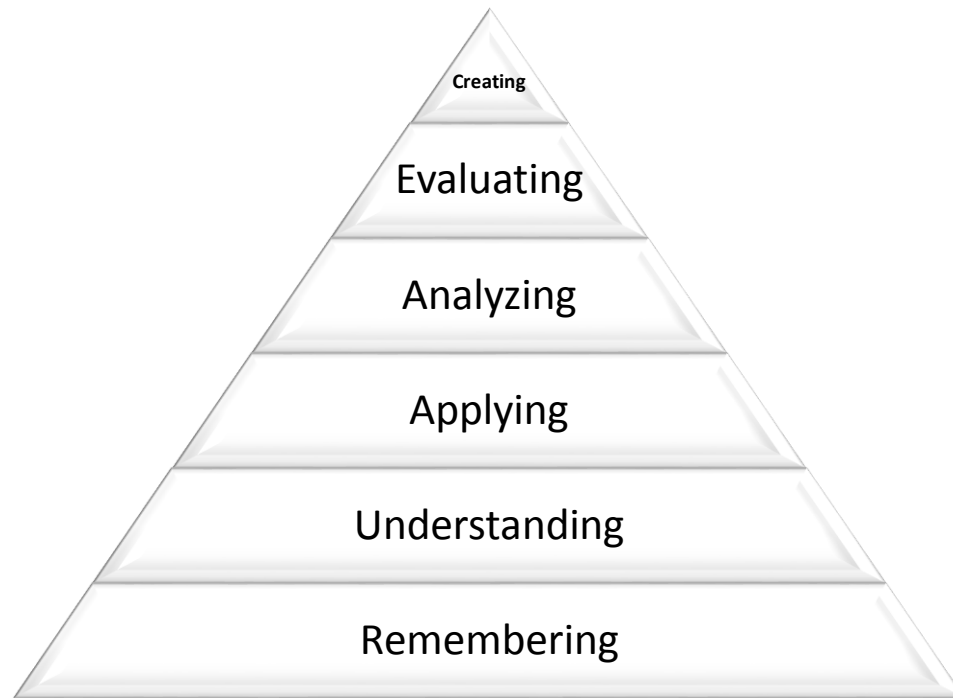


Figure 4. Bloom's revised taxonomy.

Bloom's revised taxonomy is much more detailed and descriptive when it comes to assessing deeper levels of cognitive complexity as opposed to Bloom's original taxonomy. The final dimension echoes the very nature of my study, creativity. Although proven to be useful for assessing and aligning curriculum as well as test items, Bloom's taxonomy did not provide me with the direct connection between creativity, depth of knowledge and cognitive complexity that other frameworks have.

Blank, Porter, and Smithson's Surveys of Enacted Curriculum (SEC)

Blank, Porter, and Smithson (2001) created the Surveys of Enacted Curriculum as a cognitive alignment tool to assess content within intended and enacted curricula and to produce more reliable results for the assessed curriculum. Porter (2011) states that his method does not align test items with intended curriculum objectives; rather, "it employs a two-dimensional framework defining content at the intersections of topics and cognitive demands" (Porter et al.,

2011, p. 104). Niebling (2012) states that the SEC model, used in Porter's (2011) study, can be considered one of the better alignment tools on the market today. Niebling (2012) contends that the SEC (2001) is a reliable tool that can assess all components of a curriculum as well as the complex connections needed in alignment studies (Niebling, p. 10). Martone and Sireci (2009) and Porter et al. (2011) contend that this nationally recognized tool has the ability to "compare any two content standards, assessments, curriculum materials, and instructional practices" (Porter et al., 2011 p.105) Porter's (2011) cognitive demand classification includes memorization, explanation, generating and understanding, investigation and making connections. Detailed descriptions of Porter's (2011) Surveys of Enacted Curriculum framework are as follows:

- **Memorize, Recall**

Recite, Reproduce, Identify, Recall, and Describe

- **Perform Procedures, Explain**

Follow procedures/instructions, summarize, identify purpose, main ideas, Gather information, solve equations/formulas, routine word problems, organize or display data, read or produce graphs and tables, execute geometric constructions

- **Demonstrate, Understand, Generate**

Communicate new ideas, create/develop connections, recognize relationships, explain findings, develop/explain relationships, integrate with other topics and subjects

- **Conjecture, Generalize, Prove, Analyze, Investigate**

Determine the truth of a mathematical pattern or proposition, Categorize/schematize information, compare and contrast, write formal or informal proofs, analyze data,

make inferences, draw conclusions, predict probable consequences, reason inductively or deductively

- **Solve Non-Routine Problems, Make Connections, Evaluate**

Apply and adapt a variety of appropriate strategies to solve problems, apply mathematics, recognize, generate, synthesize content and ideas from several sources, determine relevance appropriateness, credibility, test conclusions, hypotheses, generalize, and critique.

The CCSSO used Blank, Porter, and Smithson's SEC (2001) to conduct an alignment study in which the Common Core State Standards were compared to varying state standards. Thirty-five specialists were hired, including content experts who coded and analyzed the standards. In this study, the SEC proved to be a powerful tool when it came to degree of alignment, although not all states were included in the study. Furthermore, alignment percentages were the only data provided for individual states as well as an overall summative rating for all states under each component of the framework (i.e., memorize, perform procedures, conjecture, etc.). For New Jersey, the Math Common Core for Grades three and eight were the only grades and subject studied aligning the CCSS to the NJCCCS. English Language Arts was not included in the study.

As popular as this model has been to align standards with a classification of cognitive demand, other models, such as Webb's Depth of Knowledge, still seemed to provide a deeper and higher order level of cognitive complexity when assessing an intended curriculum as well as a simpler method for coding with only four cognitive levels instead of five. Future research can potentially assess the same set of standards with each of the frameworks and compare the differences.

Lopez, Newmann, and Bryk's *The Quality of Intellectual Work in Chicago Schools*

Lopez, Newmann, and Bryk (1998) created a framework to assess the cognitive demand of classroom assignments and student work. Lopez, Newmann, and Bryk's report on *The Quality of Intellectual Work in Chicago Schools: A Baseline Report (1998)* was the first part of *The Chicago Annenberg Challenge*. *The Chicago Annenberg Challenge* funded schools and organizations that attempted to reform education and improve teaching and learning (Lopez et al., 1998). "Authentic intellectual work involves original application of knowledge and skills and the changing economy and workplace have escalated the demand for intellectual competence" (Lopez et al., 1998, pp. 12,15).

Lopez et al. (1998) describe their standards used to assess assignments in writing as follows:

1. Construction of Knowledge: The assignment asks students to interpret, analyze, synthesize, or evaluate information in writing about a topic, rather than merely to reproduce information.
2. Disciplined Inquiry: Elaborated Written Communication: The assignment asks students to draw conclusions or make generalizations or arguments and support them through extended writing.
3. Value Beyond School: Connection to Students' Lives: The assignment asks students to connect the topic to experiences, observations, feelings, or situations significant in their lives.

Lopez et al. (1998) used a framework to study the intellectual value of student work in writing and mathematics. The study defined authentic intellectual work as the "original application of knowledge and skills" (Lopez et al., 1998, p. 12). The words *original*, *application* and *prior knowledge* have been echoed throughout my study and are at the foundation of

creativity. Although Lopez and her colleagues called it “authentic work,” the phrase can be used synonymously with creative work. Lopez et al. (1998) assessed grades three, six, and eight mathematics and writing samples of student work from 12 different schools in the Chicago area. Similar to most studies in my research, the study found that writing made “higher demands for student work” (Lopez et al., 1998, p. 24). Although the study still had some disappointing results for educators looking to find deeper and higher levels of creative skills within student work, 74% of third grade writing, 56 % of sixth grade writing, and 43% of eighth grade writing showed minimal to no “quality of intellectual work.” Mathematics brought in even lower numbers, with 84% of third graders’ sample work, 71% of sixth graders’ sample work, and 86% of eighth graders’ sample work showing minimal to no “quality of intellectual work.” Lopez et al. (1998) succeeded in using their standards to assess the task at hand, authentic student work. Although useful, their standards would not sufficiently assess deeper levels of complex learning as they relate to creativity because creativity involves more than simply stating what is original and what is purposeful; it is a complex web of 21st century skills such as critical, analytical, strategic, and innovative forms of thinking.

Karin Hess’s Cognitive Rigor (CR) Matrix

Karin Hess used her own prior knowledge to make a bold connection based on two powerful and well-known tools used to measure cognitive rigor, Bloom’s Revised Taxonomy and Webb’s Depth of Knowledge. Although Hess did not create or have any input into either of the two frameworks, she was able to formulate the idea that connecting these two frameworks can serve a valuable purpose. Referring to our literature on creativity, Hess’s creation of her Cognitive Rigor Matrix thus becomes a hallmark of creative thinking due to her ability to use *prior knowledge* to make the *connections* and create a matrix that has proven to be *purposeful*. Hess felt that the verb indicators within Bloom’s Revised Taxonomy were not sufficient to gauge

the level of cognitive complexity within a test item (Hess, Carlock, Jones, & Walkup, 2009, p.

1). Bloom’s Revised Taxonomy, which includes cognitive processes and knowledge, was combined with Webb’s DOK or “depth to which we expect students to demonstrate content” (Hess et al., 2009, p. 2). Hess (2009) understood that both had very strong ties to cognitive complexity, but they differed in “scope and application” (p. 3). “Both the thinking processes and the depth of content knowledge have direct implications in curricular design, lesson delivery, and assessment development and use.” Below is a sample of Hess’s Cognitive Rigor Matrix with specific English Language Arts Curriculum examples:

Table 1

Hess’s Cognitive Rigor Matrix

Revised Bloom’s Taxonomy	Webb’s DOK Level 1 Recall & Reproduction	Webb’s DOK Level 2 Skills & Concepts	Webb’s DOK Level 3 Strategic Thinking/ Reasoning	Webb’s DOK Level 4 Extended Thinking
Remember Retrieve knowledge from long-term memory, recognize, recall, locate, identify				
Understand Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion	<ul style="list-style-type: none"> Describe or define facts, details, terms Select appropriate words to use when intended meaning/definition is clearly evident Write simple sentences 	<ul style="list-style-type: none"> Specify, explain, show relationships; explain why, cause-effect Give non-examples/examples Take notes; organize ideas/data 	<ul style="list-style-type: none"> Explain, generalize, or connect ideas using supporting evidence (quote, example, text reference) Write multi-paragraph composition for specific purpose, focus, voice, tone, & audience 	<ul style="list-style-type: none"> Explain how concepts or ideas specifically relate to <i>other</i> content domains or concepts Develop generalizations of the results obtained or strategies used and apply them to new problem situations
Apply Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task	<ul style="list-style-type: none"> Apply rules or use resources to edit specific spelling, grammar, punctuation, conventions, word use 	<ul style="list-style-type: none"> Use context to identify the meaning of words/phrases Obtain and interpret information using text features 	<ul style="list-style-type: none"> Revise final draft for meaning or progression of ideas Apply internal consistency of text organization and structure to composing a full composition Apply a concept in a new context 	<ul style="list-style-type: none"> Select or devise an approach among many alternatives to research a novel problem
Analyze Break into constituent parts, determine how parts relate, differentiate	<ul style="list-style-type: none"> Decide which text structure is appropriate to audience and purpose 	<ul style="list-style-type: none"> Compare literary elements, terms, facts, details, events Analyze format, organization, & 	<ul style="list-style-type: none"> Analyze interrelationships among concepts, issues, problems Apply tools of author’s craft (literary devices, viewpoint, or potential dialogue) with 	<ul style="list-style-type: none"> Analyze multiple sources of evidence, or multiple works by the same author, or across

between relevant-irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct		internal text structure (signal words, transitions, semantic cues) of different texts	intent <ul style="list-style-type: none"> ○ Use reasoning, planning, and evidence to support inferences made 	genres, or time periods <ul style="list-style-type: none"> ○ Analyze complex/abstract themes, perspectives, concepts ○ Gather, analyze
Evaluate Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique			<ul style="list-style-type: none"> ○ Cite evidence and develop a logical argument for conjectures ○ Describe, compare, and contrast solution methods ○ Verify reasonableness of results ○ Justify or critique conclusions 	<ul style="list-style-type: none"> ○ Evaluate relevancy, accuracy, & completeness of information from multiple sources ○ Draw & justify conclusions
Create Reorganize elements into new patterns/structures, generate, hypothesize, design, plan, produce	<ul style="list-style-type: none"> ○ Brainstorm ideas, concepts, problems, or perspectives related to a topic or concept 	<ul style="list-style-type: none"> ○ Generate conjectures or hypotheses based on observations or prior knowledge and experience 	<ul style="list-style-type: none"> ○ Develop a complex model for a given situation ○ Develop an alternative solution 	<ul style="list-style-type: none"> ○ Synthesize information across multiple sources or texts ○ Articulate a new voice, alternate theme, new knowledge or perspective

Hess's (2009) Cognitive Rigor Matrix was used for two significant studies of Mathematics and English Language Arts enacted curriculum. Curriculum specialists analyzed thousands of samples of student work and aligned them with the corresponding matrix cell. The results of these studies found that a majority of the English Language Arts assignments were classified to be at DOK Level 2 and Bloom 2. The results for Math were less impressive, with a majority of the assignments being rated DOK Level 1 and Bloom 3 (Hess et al., 2009, p. 7). The study proved that we can increase motivation in learning when students are exposed to cognitively complex items and assignments with prior knowledge as the foundation (Hess et al., 2009, p. 8). Hess's matrix was certainly an innovative way of looking at and assessing cognitive complexity, but as I stated with Bloom 1 and 2, this research is mainly interested in the depth of complex understanding that leads to creative and critical thinking. In addition, the matrix could prove to be difficult to use when trying to use it to assess standards or intended curricula as opposed to enacted curricula or student work. It can also prove to be confusing if a standard is

rated high on Bloom's scale and low on Webb's DOK scale. Webb's DOK by itself has been a more widely accepted way of measuring and assessing standards.

Yuan and Le's Deeper Learning Initiative: RAND Corporation

"The William and Flora Hewlett Foundation's Education Program initiated a new strategic initiative in 2010 that focuses on students' mastery of core academic content and their development of *deeper learning skills* (i.e., critical-thinking, problem-solving, collaboration, communication, and learn-how-to-learn skills)" (Yuan & Le, 2012, p. iii). Kun Yuan and Vi-Nhuan Le (2012) conducted a study for RAND Education, a unit of RAND Corporation, titled *Estimating the Percentage of Students Who Were Tested on Cognitively Demanding Items Through the State Achievement*. The goal of the Hewlett foundation is of particular interest to me, as they strive to track and increase deeper learning in our intended, enacted, and assessed curriculum as well as make it an integral part of school culture.

Yuan and Le chose 17 states that had state assessments in Grades 3-8 that encompassed cognitive complexity and rigor for their study. Grades 3-8 were chosen as well as Grade 11 based on the fact that these were the main grades tested in English Language Arts and Mathematics. This made acquiring assessment data easier. Similar to my study, Yuan and Le (2012) reviewed multiple frameworks but felt that Webb's Depth of Knowledge framework would be the better tool to assess deeper learning skills within the assessment. Webb's DOK best fit their need to assess the cognitive rigor of a test item as opposed to the other frameworks which are usually used to describe "cognitive rigor elicited by the task at hand" (Yuan & Le, 2012, p. xii). Students were mainly tested on critical thinking, problem solving, and written communication; therefore, Yuan and Le had to limit their study to the cognitive complexity of these three assessment strategies. Subject-specific criteria were applied for each DOK level (i.e.,

mathematics, writing, and reading). Yuan and Le (2012) felt that Webb's DOK Level 4, which refers to extended levels of thinking, best matched the "*Deeper Learning Initiative's* concept of deeper learning"; thus, DOK Level 4 was used as their indicator to assess whether or not a test item met their criteria of deeper learning (p. xii). Yuan and Le (2012) found a large majority of test items, with the exception of some open-ended questions, which scored at low DOK 1 and 2 levels. The results further explained how only 3%-10% of U.S. students in Grades 3-8 and Grade 11 were assessed on deeper and more complex levels of learning. Although New Jersey was not used in this study, this further rationalized the need for my study. It is understood that PARCC and Smarter Balance assessments that align to the Common Core have yet to be released, but these statistics already paint a grim picture of the state of our state's creative skills. On the other hand, if the tests used in Yuan and Le's study were not aligned to the Common Core, it can potentially justify why those states adopted the Common Core. In addition, if the CCSS contain the cognitive rigor the creators claim it contains, students in these states can potentially perform at a higher depth of creative cognition. That is only if the tests are properly aligned with the standards from the onset. Yuan and Le pointed out five cautions, but it was the third caution that impressed me the most. Yuan and Le stated the following:

Because of the interdependence between critical thinking and problem solving skills and fluency with the core concepts, practices, and organizing principles that constitute a subject domain, it is necessary to develop an analytic framework that would allow an analysis of the mastery of core conceptual content as integrated with critical thinking and problem solving. Although this task was beyond the scope of the time and resources available for this study, future studies examining

the foundation's Deeper Learning Initiative should consider frameworks that define fundamental concepts and knowledge for each subject area. (p. xv.)

Although unknown to me before I began my research, it seems my study did exactly what Yuan and Le were recommending. The Deeper Learning Initiative has officially set the bar to advocate and fund deeper creative and complex levels of learning nationwide. Their goal is that 15% of all students will be assessed on deeper learning skills by 2017. Yuan and Le argue that a framework to measure “mastery of core conceptual content as integrated with critical thinking and problem solving” needs to be developed and used (Yuan & Le, 2014, p. xvi). The framework is already developed and was used by them in their study. Along with proving successful to assess deeper levels of complex learning for tests items, Webb's DOK has also been successful in assessing standards, which is why I chose this framework as the theoretical model for my study. Hopefully, my research can help to expedite this foundation's initiative and reach an even higher percentage of students to experience deeper learning by tackling the problem at the root of education, the intended curriculum, educational content standards.

Theoretical Framework

Despite differences in cognitive assessment and understanding, the frameworks reviewed in this chapter seem to have a central focus of aligning cognitive demand of a specific task or assignment as opposed to a standard or *pre-inventive structure*. Creative work comes from a deep understanding of prior content knowledge and the ability to make connections. Webb contended that the cognitive complexity or depth of knowledge of an item has a direct correlation with the strength of cognitive connections made from prior and current knowledge (Jirka & Hableton, 2005, p. 7).

Alignment of standards to assessments has been an important tool in assessing the accuracy of state standards as compared to state assessments (Wyse & Viger, 2011, p. 185). The Elementary and Secondary Education Act (1965) argues that states must be in compliance with properly aligning state tests with standards; if this is not completed, states can lose valuable funding (p. 185). Webb's Depth of Knowledge and the Surveys of Enacted curriculum have been the most widely researched and used tools that assess the alignment of intended, enacted, and assessed curricula (p. 186). Alignment reform efforts are used on the premise that academic achievement will improve if students are tested on what they are taught (Webb, 1997). Webb (1997, 2007) uses four standards to address alignment issues:

1. **Categorical Congruence** measures the extent to which the same or consistent categories of content appear in both the content standards and the assessment.
2. **Depth of Knowledge (DOK) Consistency** measures the extent to which the cognitive demands in the content standards are the same as what people are required to know and do on the assessment.
3. **Range of Knowledge Correspondence** measures the extent to which the content standards and the assessment cover a similar span of knowledge.
4. **Balance of Representation** measures the extent to which the knowledge is distributed similarly in the content standards and the assessment (as cited in Wyse & Viger, 2011, p. 186).

The theoretical framework of this study used Webb's second criteria, which focuses on Depth of Knowledge Consistency, to analyze, code, and compare the Grades 9-12 ELA and Math CCSS to the Grades 9-12 ELA and Math NJCCCS based on cognitive complexity. According to Webb (1997), Depth of Knowledge can encompass multiple dimensions. This can

range from “level of cognitive complexity of information students should be expected to know, how well they should be able to transfer this knowledge to different contexts, how well they should be able to form generalizations, and how much prerequisite knowledge they must have in order to grasp ideas” (Webb, 1997, p. 15). Webb’s (2007) four Depth of Knowledge (DOK) levels were used as the theoretical framework for this study:

Level 1 (recall)—Items at this level require examinees to recall a simple definition, term, fact, procedure, or algorithm.

Level 2 (skill/concept)—Items at this level require examinees to develop some mental connections and make decisions on how to set up or approach a problem or activity to produce a response.

Level 3 (strategic thinking)—Items at this level require examinees to engage in planning, reasoning, constructing arguments, making conjectures, and/or providing evidence when producing a response. Items at this level require some complex reasoning and connections to be made.

Level 4 (extended thinking)—Items at this level require examinees to engage in complex planning, reasoning, conjecturing, and development of lines of argumentation. Items at this level require examinees to make multiple connections between several different key and complex concepts.

“The depth of knowledge required by an expectation or in an assessment is related to the number of connections of concepts and ideas a student needs to make in order to produce a response, a level of reasoning, and the use of other self-monitoring processes” (Webb, 1997, p. 15). Assessing standards before aligning them to any other external assessment, assignment, book, lesson plan, or curriculum will allow educators to know at the outset if the intended

curriculum was designed to offer a strong foundation in creative and complex thinking. It is important to note that the “DOK level of an item does not refer to how easy or difficult a test item is for students” (Wyse & Viger, 2011, p. 188). Webb (1997) described Depth of Knowledge within an educational objective as cognitively complex, involving the numerous connections students make from prior knowledge to current knowledge using strategic and extended forms of thinking in order produce an idea that is original and purposeful (p. 15).

Although student motivation and response to teaching and learning is an important part of creative processes, Webb’s DOK levels are directly related to the cognitive demand/complexity of the actual item, not external factors. However, in order for a student to attempt to make the connections and use higher-order and deeper levels of thinking, the foundation must be designed in a way that students can build on it to a level of strategic and extended thinking. With the widespread use of Webb’s framework in assessing the cognitive complexity of the Common Core State Standards and the strong link between cognitive complexity, depth of learning, and creativity, this study provides insight into the creativity of a standard. This study provides evidence that creativity is cognitively complex and depth of knowledge measures cognitive complexity; thus, using DOK to measure an educational standard proved to be an effective means to measure the creativity of a standard. This study focused on the distribution of cognitive complexity within the Grades 9-12 ELA and Math Common Core State Standards as compared to the Grades 9-12 ELA and Math New Jersey Core Curriculum Content Standards.

Policy makers must be cautious when using frameworks such as Webb’s DOK and understand, based on the NAEP study, that although deeper levels of complex cognition should be promoted in every standard, it must also align with the developmental levels of a child. Furthermore, using Webb’s DOK (1997, 2007) provided a different perspective on how much

more creative and cognitively complex the new Grades 9-12 Common Core State Standards in ELA and Math are as compared to the older Grades 9-12 New Jersey Core Curriculum Content standards in ELA and Math. While existing research has used the frameworks for alignment purposes, my study serves as a “descriptive, not alignment, study” and describes specifically what the creative potential, based on cognitive complexity, is of each standard as well as provides the ability to assess and compare two sets of standards based on cognitive complexity and 21st century skills. (Niebling, 2012, p.13). In a sense, this makes my research within the field of creativity and cognitive complexity original and innovative and purposeful. This is not only because I sought to understand and study how to classify standards based on cognition and creativity but also because the research proved to be purposeful. The purposeful component can give curriculum writers and policy makers a better idea of how to assess the creativity of a product, such as education standards, based on a simple and widely used framework, Webb’s DOK. Creativity needs to be embraced and embedded into content objectives so that a student can have the opportunity to make “the most important decision in his or her life: the decision to be creative” (Sternberg, 2003, p. 337).

An in-depth analysis of the methodology for this study will be found in the next chapter. Chapter III includes an introduction of the present study, my three research questions, and a detailed description of the purpose/design of this study. Additional components of Chapter III include a review of the coding scheme used, a description of the trained consultant coders’ qualifications and experience, my method of ensuring credibility, the training involved before coding the standards, and my method of analyzing the standards based on Webb’s Depth of Knowledge.

CHAPTER III

METHODOLOGY

Introduction

In this chapter, I describe in detail the methods used for this study. The chapter begins with an introduction, followed by the research questions, design of the study, validity and reliability, coding protocol, data collection, content analysis, and conclusion. In this study, I sought to describe and compare the distribution of cognitive complexity, as defined by Webb's Depth of Knowledge, between the English Language Arts and Math Common Core State Standards and New Jersey Core Curriculum Content Standards in Grades 9-12. Schools across the country are increasingly called upon to prepare students with cognitively complex 21st century skills such as creativity, innovation, problem solving, and critical and analytical thinking (American Society for Training and Development, 2009; IBM Study, 2010; Kyllonen, 2012). While educational policy makers have continued to focus on increasing academic rigor and standardizing the education system, business leaders require students to prepare for careers with more creativity and analytical, practical, and problem-solving skills (IBM Study, 2010; Kyllonen, 2012). These skills have been at the core of what many call 21st century skills and 21st century learning.

It is "clear that educators and employers claim that 21st century skills are important for schools to develop and for students to possess in order to be successful in the 21st century workplace" (Kyllonen, 2012, p. 18). However, despite a "growing appreciation" of the significant importance of 21st century skills in business and education over the past 10 years (Kyllonen, 2012, p. 3), these skills have not been commonly tested on standardized tests, which usually test other cognitive skills, specifically in the areas of English Language Arts and Math. Therefore, the purpose of this dissertation was to examine the cognitive complexity of the

Common Core State Standards as compared to those of the New Jersey Core Curriculum Content Standards. Most educators believe that if schools were “injected” with creativity and innovation, our students would have a better chance at a prosperous and productive future (NEA, 2012; Cachia, Ferrari, Ala-Mutka, & Punie, 2010). My intent was to assess the cognitive complexity of the Grades 9-12 Math and English Language Arts Common Core State Standards (CCSS) as compared to the cognitive complexity within the Grades 9-12 Math and English Language Arts New Jersey Core Curriculum Content Standards (NJCCCS,) using Webb’s Depth of Knowledge framework. The outcomes of this study can provide a descriptive assessment of cognitive complexity distribution between one set of standards as compared to the other.

Research Questions

1. To what extent is cognitive complexity, as defined by Webb’s Depth of Knowledge, embedded in the Common Core State Standards for English Language Arts and Mathematics, Grades 9-12?
2. To what extent is cognitive complexity, as defined by Webb’s Depth of Knowledge, embedded in the New Jersey Core Curriculum Content Standards for English Language Arts and Mathematics, Grades 9-12?
3. What differences and similarities exist in cognitive complexity between the Common Core State Standards and New Jersey Core Curriculum Content Standards in English Language Arts and Mathematics for Grades 9-12?

Research Design

Webb's Depth of Knowledge methodology, adapted from the Web Alignment Tool (WAT) training manual (2005), is best suited for the coding requirements in this study. "Webb's (1997) alignment methodology, traditionally used to evaluate the alignment between academic content standards and academic content assessments, has been adapted to study the alignment between different sets of standards" (Chi, 2011, p. 6). The Common Core State Standards (CCSS) and New Jersey Core Curriculum Content Standards (NJCCS) were analyzed, step by step, utilizing Webb's DOK levels derived from the WAT (Webb, 2005). Webb's second criterion evolving from the WAT training manual is Depth of Knowledge (DOK) Consistency. DOK was used as an analytical tool to code and compare the cognitive complexity of the standards between the CCSS and the NJCCCS in Grades 9-12 in ELA and Math. This study included all standards and substandards. Sato et al.'s (2011) Smarter Balanced Study deviated from Webb's (2005) recommendations by giving multiple ratings to one Common Core standard to account for the substandard. Another study, Florida State University's (2012) CPALMS study, gave one rating for each Common Core standard and all substandards below that standard. This study went deeper by specifying the code for every single standard and substandard within the Grades 9-12 ELA and Math CCSS and NJCCCS. Webb's (2005) four Depth of Knowledge (DOK) levels that were adapted for this study are as follows:

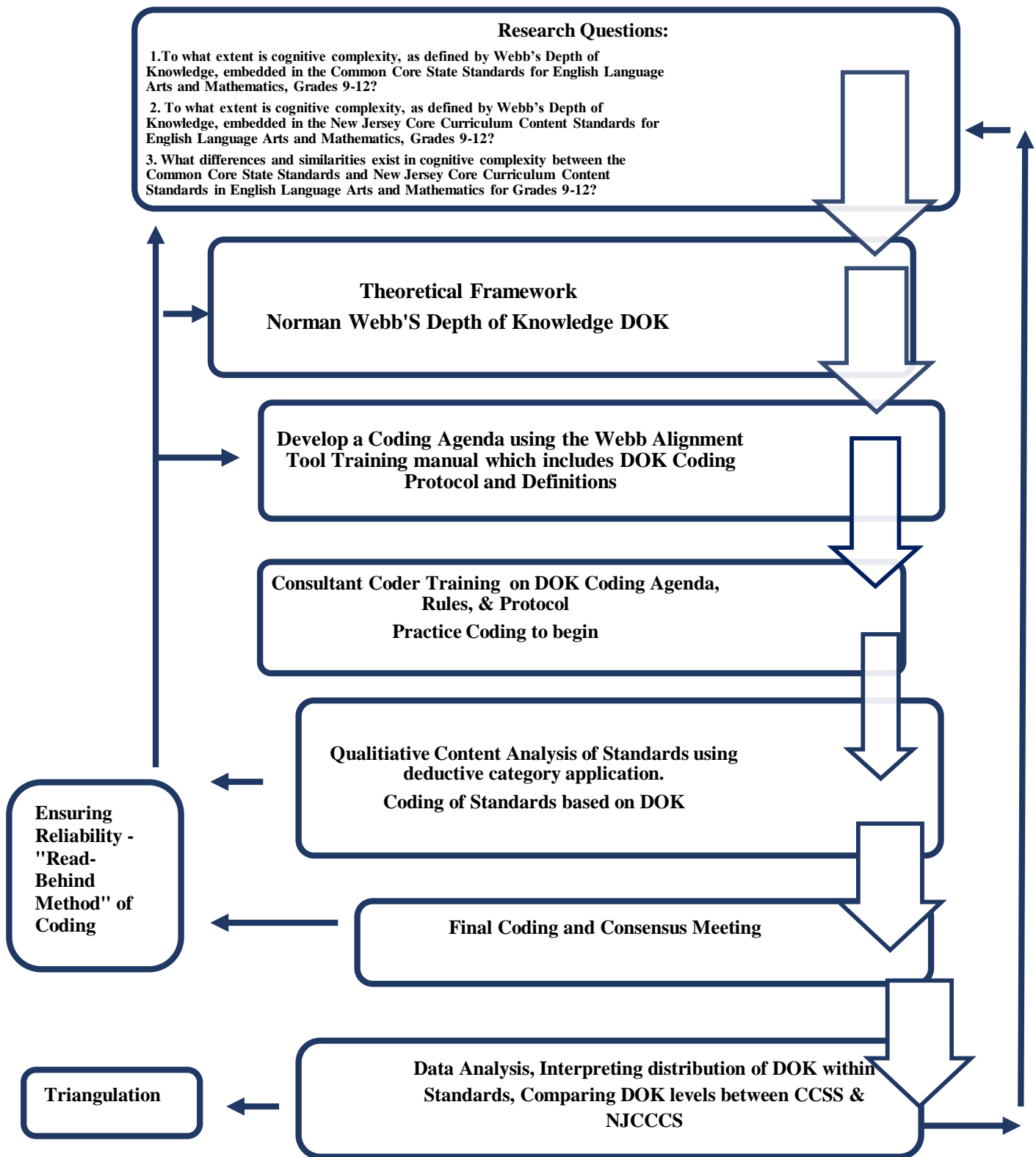
Level 1 (recall)—Items at this level require a student to recall a simple definition, term, fact, procedure, or algorithm.

Level 2 (skill/concept)—Items at this level require a student to develop some mental connections and make decisions on how to set up or approach a problem or activity to produce a response.

Level 3 (strategic thinking)—Items at this level require a student to engage in planning, reasoning, constructing arguments, making conjectures, and/or providing evidence when producing a response. Items at this level require some complex reasoning and connections to be made.

Level 4 (extended thinking)—Items at this level require a student to engage in complex planning, reasoning, conjecturing, and development of lines of argumentation. Items at this level require a student to make multiple connections between several different key and complex concepts

In this study, I employed a qualitative content analysis method to code the standards. Qualitative content analysis refers to “a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (Hsieh & Shannon, 2005, p. 1278). Deductive category application was used to connect Webb’s existing Depth of Knowledge framework to the existing CCSS and NJCCSS (Mayring, 2000). Each Depth of Knowledge level presents a specific level of cognitive complexity. The higher the DOK level of a standard, the more cognitively complex the standard. The higher the cognitive complexity of a standard, the more creativity and innovation embedded into the standard. Figure 5 shows the *Step Model* of deductive category application, as described by Mayring (2000). Mayring’s *Step Model* was used in this study to describe the process in coding and analyzing the standards.



Adapted from Mayring (2000)

Figure 5. Step model.

When evaluating a documents page, one needs to ensure the authenticity and accuracy of the document (Merriam, 2009, pp. 151-152). Merriam (2009) contends that after the authenticity has been established, “the researcher must adopt some system for coding and cataloging” the documents (p. 152). Hsieh and Shannon (2005) stress that the “success of a content analysis depends greatly on the coding process” (p. 1285). In this study, the Grades 9-12 Common Core English Language Arts and Mathematics standards and Grades 9-12 NJCCCS in English Language Arts and Mathematics were analyzed and coded based on the corresponding DOK level. Each standard was rated on a 1-4 Depth of Knowledge level based on Webb’s Depth of Knowledge methodology. Utilizing the step model as my guide, a coding agenda was created, using Mayring’s (2000) template and the DOK definitions, examples, and coding rules as described in the Webb Alignment Tool (WAT) training manual. In addition, instead of aligning the standards to an external assessment or curriculum, the primary purpose of this study was to assess and compare the cognitive complexity, embedded in standards and described by each DOK level, of one set of education standards as compared to another. Sato, Lagunoff, and Worth’s (2011) study used WAT to code their standards based on DOK. The WAT training manual recommends five analysts when coding and reaching consensus on each standard. Similar to Sato et al.’s study, this study deviated slightly from Webb’s protocol of five analysts and used only two analysts. Two analysts, using Webb’s coding protocol, have already proven effective in two wide-scale studies that used the WAT to analyze and code standards based on their Depth of Knowledge complexity (Yuan & Le, 2012; Sato et al., 2011). Inter-rater reliability was addressed by involving a qualified and trained second coder, a New York City high school principal, in order to increase the validity within the coding process. My trained consultant coders’ qualifications are described in detail in the next section.

Consultant Coder

Given that the experience and qualifications of both analysts were critical to the quality of this study (Sato et al., 2011), a fully trained and qualified second coder was asked to review, code, and reach consensus on DOK levels assigned to each of the standards in this study. My trained consultant coder is a secondary school New York City principal who holds a doctorate in Education, Leadership, Management, and Policy. In addition to her current role as high school principal, she is also a New York State Regent's writer and supervisor, a New York state consultant for the PISA pilot, and School District Administrator and School Building Leader for certification exams. My trained consultant coder also has experience with large-scale assessment and reviewing independent curriculum units for the New York Department of Education.

Coding Scheme

A review of literature in Chapter II reveals that Webb's DOK methodology is the most closely linked to cognitive complexity, a measure of 21st century skills such as creativity and innovation. Webb's DOK methodology provides definitions, rules, samples, and a simple method of coding with only four detailed levels, as opposed to some studies which have five or more. "These levels were developed specifically for K–12 standards and alignment studies and are widely used in alignment studies throughout the nation" (Sato et al., 2011, p. 10). The outcomes of this study were not intended for alignment between standards and tests items, but rather for a descriptive comparison of cognitive complexity distribution between one set of standards as compared to another. Webb (2007) describes that the coding process must involve a standardized language, goal, or objective. A portion of Webb's Alignment Tool training manual (Appendix A) contains important definitions, explanations, and examples in order for coders to reference and specifically understand what the DOK levels should look like for English Language Arts and Mathematics objectives. Webb's clear definitions of each DOK level assisted

in the coders' reliability of their ratings (Webb, 2005). Listed below is a sample of rules adapted from the WAT training manual that the two coders followed when assigning DOK levels to each standard.

- The DOK level of an objective should be the level of work students are most commonly required to perform at that grade level to successfully demonstrate their attainment of the objective.
- The DOK level of an objective should reflect the *complexity* of the objective, rather than its *difficulty*. The DOK level describes the kind of thinking involved in a task, not the likelihood that the task will be completed correctly.
- In assigning a DOK level to an objective, think about the complete domain of items that would be appropriate for measuring the objective. Identify the depth-of-knowledge level of the most common of these items.
- If there is a question regarding which of two levels an objective addresses, such as Level 1 or Level 2, or Level 2 or Level 3, it is usually appropriate to select the higher of the two levels.
- The team of reviewers should reach consensus on the DOK level for each objective before coding any items for that grade level.

Adapted from page 36 of Web Alignment Tool (WAT) Training Manual
<http://www.wcer.wisc.edu/WAT/Training%20Manual%202.1%20Draft%20091205.doc> Norman L. Webb and others

Each deductive category within the step model has explicit definitions, examples and DOK coding rules adapted from WAT training manual (Mayring, 2000). The descriptions made certain that coders understood precisely which DOK levels should be assigned to each standard (see Appendix A). Mayring's step model (Table 2) template was adapted and revised for this study to include descriptions of Webb's depth of knowledge (DOK) levels that were excerpted

from the Web Alignment Tool (WAT) training manual (Webb, 2005, pp. 45-46, 70–75). Two coding agendas were developed, one for all mathematics (Table 2 and Appendix B) standards and one for all English Language Arts standards (Appendix C). In addition, Webb’s DOK wheel (Appendix D) was used as an additional reference tool to ensure reliability and consistency within the coding process.

Table 2

Sample Coding Agenda for Math (For full Version, see Appendix B)

Category	Definition	Examples	Coding Rules
Level 1 (recall)	<i>Level 1 (Recall)</i> includes the recall of information such as a fact, definition, term, or a simple procedure, as well as performing a simple algorithm or applying a formula. That is, in mathematics, a one-step, well defined, and straight algorithmic procedure should be included at this lowest level.	Read, write, and compare decimals in scientific notation.	Items at this level require a student to recall a simple definition, term, fact, procedure, or algorithm
Level 2 (skill/ concept)	<i>Level 2 (Skill/Concept)</i> includes the engagement of some mental processing beyond an habitual response. A Level 2 assessment item requires students to make some decisions as to how to approach the problem or activity...	Construct two-dimensional patterns for three-dimensional models, such as cylinders and cones.	Items at this level require a student to develop some mental connections and make decisions on how to set up or approach a problem or activity to produce a response.
Level 3 (strategic thinking)	<i>Level 3 (Strategic Thinking)</i> requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. In most instances, requiring students to explain their thinking is at Level 3. Activities that require students to make conjectures are also at this level. The cognitive demands at Level 3 are complex and abstract. The complexity does not result from the fact that there are multiple answers, a possibility for both Levels 1 and 2, but because the task requires more demanding reasoning.	Solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of results.	Items at this level require a student to engage in planning, reasoning, constructing arguments, making conjectures, and/or providing evidence when producing a response.
Level 4 (extended thinking)	<i>Level 4 (Extended Thinking)</i> requires complex reasoning, planning, developing, and thinking, most likely over an extended period of time. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require applying significant conceptual understanding and higher-order thinking. At Level 4, the cognitive demands of the task should be high and the work should be very complex. Students should be required to make several connections—relate ideas <i>within</i> the content area or <i>among</i> content areas—and have to	Design a statistical experiment to study a problem and communicate the outcomes. For example, if a student has to take the water temperature from a river each day for a month and then construct a	Items at this level require a student to engage in complex planning, reasoning, conjecturing, and development of lines of argumentation. Items at this level require a student to make multiple

	select one approach among many alternatives on how the situation should be solved, in order to be at this highest level.	graph, this would be classified as a Level 2.	connections between several different key and complex concepts.
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Adapted from the Web Alignment Tool (WAT) training manual, Table 3 shows a sample template of how Webb suggests analysts should code and record each standard. The template used in this study, adapted from Niebling's (2012) study, was slightly modified. (see Table 4). Unlike the sample adapted from the WAT, Niebling's template has four columns labeled Level 1, 2, 3, and 4, referring to the respective DOK level. Adapting Niebling's template added validity to this study, as the template did not discourage coders from choosing more than one DOK level. However, as noted in the DOK rules, this study followed Webb's recommendation, which was to choose the higher of the two DOK levels when coders had difficulty in reaching consensus.

Table 3

Sample Paper Version of Webb's Standards Coding Template

Wisconsin Grade 4 Mathematics Standards		Reviewer _____
Number	Standard	DOK Level
2.	Algebra	
2.a	Write number sentences for word problems that involve multiplication or division.	
2.b	Complete addition and subtraction number sentences with a missing addend or subtrahend.	
3.	Geometry	
3.a	Identify triangles, quadrilaterals, pentagons, hexagons, or octagons based on the number of sides, angles, and vertices.	
3.b	Find locations on a map or grid using ordered pairs.	
4.	Measurement	
4.a	Calculate elapsed time in hours and minutes.	
4.b	Measure length, width, weight, and capacity, using metric and customary units, and temperature in degrees Fahrenheit and degrees	
5.	Data Analysis and Probability	
5.a	Represent categorical data using tables and graphs, including bar graphs, line graphs, and line plots.	
5.b	Determine if outcomes of simple events are likely, unlikely, certain, equally likely, or impossible.	
5.c	Represent numerical data using tables and graphs, including bar graphs and line graphs.	

Table 4

NJCCCS Grades 9-12 Mathematics Depth of Knowledge DOK Coding Template

NJCCCS (MATH) 9-12 Standard DOK Coding Sheet				
NJCCS MATH Grades 9-12	2008			
Standard #				
NUMBER AND NUMERICAL OPERATIONS				
<i>STANDARD 4.1 (NUMBER AND NUMERICAL OPERATIONS) ALL STUDENTS WILL DEVELOP NUMBER SENSE AND WILL PERFORM STANDARD NUMERICAL OPERATIONS AND ESTIMATIONS ON ALL TYPES OF NUMBERS IN A VARIETY OF WAYS.</i>	DOK Level 1	DOK Level 2	DOK LEVEL 3	DOK LEVEL 4
4.1.12 A.Number Sense				
4.1.12 A.1.Extend understanding of the number system to all real numbers.				
4.1.12 A.2.Compare and order rational and irrational numbers.				
4.1.12 A.3.Develop conjectures and informal proofs of properties of number systems and sets of numbers.				
4.1.12 B.Numerical Operations				
4.1.12 B.1.Extend understanding and use of operations to real numbers and algebraic procedures.				

*Adapted from page 110 Determining the Cognitive Complexity of the Iowa Core in Literacy and Mathematics
Implications and Applications for Curriculum Alignment (Niebling, 2012).*

Ensuring Credibility

According to Merriam (2009), documentary data are persuasive, allowing little room for the researcher to “alter what is being studied” (p. 155). A document analysis is valid because it is “grounded in the product in which it was produced and therefore grounded in the real world” (Merriam, 2009, p. 156). Along with the stability within authentic documents, such as the New Jersey Core Curriculum Content Standards and the Common Core State Standards, I used additional methods to increase the validity and reliability of my research. Merriam (2009) suggests that triangulation, in a content analysis study, can help increase the credibility of qualitative research (p. 215). Merriam (2009) describes four kinds of triangulation researches can use to increase validity: (1) use of multiple methods (observations), (2) multiple sources of data (documents), (3) multiple investigators (interviews), and (4) multiple theories (p. 215). In order to ensure credibility, the findings of this study were compared to previous studies that had already been successful in coding the Common Core State Standards, using WAT for alignment purposes. Moreover, this study involved two analysts in coding each of the standards and then comparing their data and findings, thus increasing inter-rater reliability (Merriam, 2009, p. 216). The method used was a “double-rater read behind consensus model,” which proved to be an effective “reliability check” when coding standards (Miles, Huberman, & Saldaña, 2014, p. 84; Sato, Lagunoff, & Worth, 2011, p. 11). Both analysts were trained utilizing the Webb training manual (2005) on how to properly code each standard. I coded all standards based on Webb’s (2005) Depth of Knowledge (DOK) coding protocol using my revised coding agenda found in Appendix E. Maxwell (2005) recommends using member checks to ensure credibility of one’s research. Member checks were used as an additional inter-rater reliability strategy and allowed me to validate my coding analysis with that of the second coder, identifying any biases (p. 111). The same data, coding agenda, and rules of coding were used by both analysts. Content

clustering or grouping of standards, similar to Sato et al.'s (2011) study was also used in this study when coding standards. This was used when a standard or a portion of a standard overlapped with another standard or strand (Sato, Lagunoff, & Worth, 2011). Both analysts are content and curriculum specialists and were adequately trained in using Depth of Knowledge to code content standards derived from Webb's Alignment Tool training manual.

Training and Calibration

"Perhaps the most complicated work involved in using the Webb alignment model is helping coders of standards, objectives, and test items understand and reliably code them according to the DOK framework" (Niebling, 2012, p. 12). The second coder and I were trained using Webb's (2005) DOK coding protocol. Along with a thorough review of Webb's training manual, meetings to discuss the unique methods for this study were organized. Practice coding the standards was emphasized throughout the training in order to understand the coding process as well as the member check and "double-rater read behind method." I organized and documented multiple meetings with my consultant coder prior to the start of the coding to ensure there was clear understanding of the context of this study. Similar to the study conducted by Sato et al. (2011), the second coder "received an introduction to the goals and purpose of the study and an in-depth discussion of the study criteria, including the DOK level descriptions . . . to ensure a common understanding of the study criteria and procedures and to best ensure the accuracy and consistency of the application of the criteria" (p. 12). Webb's Alignment Tool training manual was carefully studied, as it contains important definitions, explanations, and examples (Appendix A). Webb's DOK definitions, explanations, and examples were incorporated into my coding agendas (Appendix B and Appendix C) in order to understand what

the DOK levels should look like for English Language Arts and Mathematics as well as assisting in the reliability of ratings (Webb, 2005).

Following initial training meetings, we began to code the Grades 9-12 Math and English Language Arts New Jersey Core Curriculum Content Standards (2009), using the “double-rater read behind consensus model” (Sato, Lagunoff, & Worth, 2011, p. 11). The read-behind method allows for ongoing consensus during the coding process. The second analyst reviewed my DOK findings and noted agreements or disagreements with each coded standard. Any disagreements were noted and discussed in follow-up meetings. Discussions continued until consensus was reached. The “double-rater read behind consensus model” continued with the second set of standards, the Grades 9-12 CCSS in ELA and Math; and additional meetings, in order to reach consensus, followed (Sato, Lagunoff, & Worth, 2011). Following the completion of all coding for the NJCCCS and CCSS, I compared our CCSS findings with Florida State University’s CPALMS (2012) study, which rated all CCSS based on DOK. Additional studies have also attempted to rate the CCSS based on DOK (e.g., Niebling’s Iowa Core, 2011; Sato et al., 2011; Porter et al., 2002), although Florida State University’s CPALMS (2012) study did not rate all standards and sub standards as my study did, I felt it matched the needs of my study best. This triangulation strategy increased the validity of this study. A final member check meeting to compare our completed and coded Common Core State Standards, based on DOK, to that of Florida’s CPALMS (2012) study was conducted in order to increase validity and reliability.

Data Analysis

The data I used for content analysis consist of two sets of standards: the Common Core State Standards and the New Jersey Core Curriculum Content Standards in English Language Arts and Mathematics. Although 45 states and the District of Columbia have adopted the standards, in this content analysis dissertation, I selected to compare the CCSS to New Jersey’s

previous standards. New Jersey's Core Curriculum Content Standards in English Language Arts and Math were robust, rigorous, and proven to be effective. Prior to the adoption of the CCSS, New Jersey had consistently ranked amongst one of the better states in education in the United States. As discussed in Chapter I, the National Assessment for Educational Progress (NAEP, 2011) ranked New Jersey at the very top of the list in reading, writing, and math; and *Education Week* (2011) highlighted New Jersey's excellent graduation rate "Number one" in the nation (Education Research Center, 2011). New Jersey also ranked at the very top in Advanced Placement and SAT scores (College Board, 2012). This evidence made it worth comparing New Jersey's past intended curriculum that led to most of the state's academic success to the newly established national standards, CCSS. In order to have a fair assessment of comparison, the past NJCCCS in English Language Arts and Mathematics were chosen. The focus of this study was to analyze the cognitive complexity of a standard objective and the importance of complex 21st century skills such as creative and critical thinking in today's college and career paths. I chose Grades 9-12 as the grade levels for this study because the probability of finding high cognitive complexity levels at grades below ninth grade begins to decrease (Cook, 2007).

My study sought to find if new reform movements in the areas of standardization are thwarting the need for our students to think critically and creatively. Previous New Jersey standards were chosen to ensure an adequate DOK comparison to the newly adopted common core. With education standards being the foundation of our students' education, the intended curriculum was strategically chosen, as it provided the most insight into how the enacted, assessed, and learned curriculum was developed (Niebling, 2012).

Chapter Summary

In this chapter, I described the coding protocol I used to code the CCSS and NJCCCS. A qualitative content analysis research methodology was chosen to answer the three research questions. The step model of qualitative content analysis research was referenced in describing, visually, the entire research process and ensuring validity and reliability. Webb's Alignment Tool training manual was used to train both coders in the process of coding each standard based on DOK. Specific definitions, examples, and coding rules were recited and then placed in an organized coding agenda. A separate coding agenda was created to be used for all CCSS and NJCCCS Math standards and English Language Arts Standards. A final, more efficient, coding template was created that included the standard number, standard objective, and DOK level. Qualified and trained coders coded the standards and then used the "Tips for Facilitating the Consensus Process" section from the WAT training manual (Appendix G) to reach consensus and increase inter-rater reliability. Should two DOK levels have been chosen for one standard objective, coders agreed to follow Webb's recommendation of choosing the higher of the two levels. The next chapter presents the findings of my study with a focus on answering all three research questions.

CHAPTER IV

RESULTS

Introduction

Chapter IV presents the findings of this study with a focus on answering the three research questions. This chapter provides a descriptive comparison between the NJCCCS and the CCSS in English Language Arts (ELA) and Math. Seven coding meetings were held with a second trained coder between the months of February and June 2014. The coding scheme used in this study was Webb's Depth of Knowledge (DOK), a methodology that helped to measure cognitive complexity in order to understand the creative or innovative potential of an educational standard. Webb's framework, which has been used nationally, was created specifically for educators to be able to align and analyze a set of standards (Sato et al., 2011, p.10). A detailed description of the DOK rules can be found in Appendix A. The higher the DOK of a standard, the more cognitively complex the standards is. The higher the cognitive complexity of a standard, the more creativity and innovation embedded into the standard.

The DOK levels are as follows:

Level 1 (recall)—Items at this level require a student to recall a simple definition, term, fact, procedure, or algorithm.

Level 2 (skill/concept)—Items at this level require a student to develop some mental connections and make decisions on how to set up or approach a problem or activity to produce a response.

Level 3 (strategic thinking)—Items at this level require a student to engage in planning, reasoning, constructing arguments, making conjectures, and/or providing evidence when

producing a response. Items at this level require some complex reasoning and connections to be made.

Level 4 (extended thinking)—Items at this level require a student to engage in complex planning, reasoning, conjecturing, and development of lines of argumentation. Items at this level require a student to make multiple connections between several different key and complex concepts.

Adapted from page 36 of Web Alignment Tool (WAT) Training Manual
<http://www.wcer.wisc.edu/WAT/Training%20Manual%202.1%20Draft%20091205.doc> Norman L. Webb and others

The method used to rate the standards is known as the “double-rater read behind consensus model” (Sato, Lagunoff, & Worth, 2011, p. 11). This model has been proven to be an effective “reliability check” when coding standards (Miles, Huberman, & Saldaña, 2014, p. 84; Sato et al., 2011, p. 11). We arrived at all DOK distributions (percentages) based on this methodology of coding standards. After both analysts coded a standard, a discussion was held until consensus was reached. The member check and “double-rater read behind consensus model” helped to identify any misinterpretations of either of our biases. Content clustering or grouping of standards, similar to Sato et al.’s (2011) study, was also used in this study when coding standards. This was used when a standard or a portion of a standard overlapped with another standard or strand (Sato et al., 2011). The standards would be clustered together and the same process of coding, review, compare, and check was used between the two raters. The same data, coding agenda, and rules of coding were used by both raters in order to reduce the amount of discrepancy prior to reaching consensus. If consensus could not be reached on a standard, we used the higher of the two DOK levels based on Webb’s recommendation. For example, on the ELA Common Core (2010) standard *9-10.RL.9*, which states, “Analyze how an author draws on and transforms source material in a specific work (e.g., how Shakespeare treats a theme or topic

from Ovid or the Bible or how a later author draws on a play by Shakespeare,” consensus was reached on DOK Level 3 rather than DOK Level 2. Even though one rater felt this ELA standard could be rated at a DOK Level 2, the rater that coded this standard at a DOK Level 3 thoroughly explained why it should be rated at a DOK Level 3. The rationale was that students had to use specific strategizing skills in order to analyze the specific literature stated in the standard; therefore, a DOK Level 3 rating was appropriate. The analyst that rated this standard at a DOK Level 2 was convinced, and consensus was reached on rating ELA CCSS *9-10.RL.9* at a DOK Level 3. Another example of how we both reached consensus was with NJCCCS (2008) Math standard *4.2.12 B.1*, which states, “Determine, describe, and draw the effect of a transformation, or a sequence of transformations, on a geometric or algebraic representation, and, conversely, determine whether and how one representation can be transformed to another by a transformation or a sequence of transformations.” In this standard, one rater coded the standard at a DOK Level 1 and the other at a DOK Level 2. Although the rater that coded the standard at a DOK Level 2 did not feel it was a strong DOK Level 2, the analyst did explain how parts of the standard fit components of a DOK Level 2 due to the fact that students are asked to construct and identify patterns. The analyst that rated this standard at a DOK Level 1 was convinced, and consensus was reached on the higher rating of DOK Level 2 for Math NJCCCS *4.2.12 B*.

Findings for Research Question 1

Research Question 1: To what extent is cognitive complexity, as defined by Webb’s Depth of Knowledge, embedded in the high school Common Core State Standards for English Language Arts and Mathematics, Grades 9-12?

English Language Arts (ELA)

The Common Core State Standards for English Language Arts in Grades 9-12 were coded using Webb's Depth of Knowledge framework. Webb assigns four Depth of Knowledge ratings, which increase in cognitive complexity from 1 to 4. "The reading levels are based on Valencia and Wixson (2000, pp. 909–935) measuring reading levels and the writing levels were developed by Marshá Horton, Sharon O'Neal, and Phoebe Winter" (Webb, 2005). See Appendix A for the authors' criteria for measuring reading and writing levels. Reading and writing at a DOK Level 1 requires simple writing, receiving, or recall of facts on the part of students. Literal comprehension of text, the use of basic grammar and punctuation, spelling by using a dictionary, and the use of a thesaurus to improve word choice are some examples of Level 1 tasks (Webb, 2005). The distribution of DOK Level 1 questions in the Grades 9-12 ELA CCSS was 37%.

Two examples of Grades 9-12 ELA standards coded at a DOK Level 1 are as follows:

Reading, Grades 9-10: 9-10.RL.10. By the end of Grade 9, read and comprehend literature, including stories, dramas, and poems, in the Grades 9–10 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Writing, Grades 11-12: 11-12.W.3.d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.

The distribution of ELA standards coded at a DOK Level 2 in the Grades 9-12 ELA CCSS was 35%. In general, reading and writing tasks at a DOK Level 2 require slightly higher levels of cognitive processing of text and material than at a Level 1. Comprehension and continued processing of readings along with unplanned speaking and simple writing tasks are some components of an ELA standard coded at a DOK Level 2. Two examples of Grades 9-12 ELA standards coded at a DOK Level 2 are as follows:

Writing, Grades 9-10: 9-10.W.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Reading, Grades 11-12: 11-12.RI.2. Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; provide an objective summary of the text.

The distribution of standards coded at a DOK Level 3 in the Grades 9-12 ELA CCSS was 26%. Deeper cognitive processing, strategic thinking, and understanding are emphasized in ELA standards coded at a DOK Level 3. “Editing and revising” as well as the ability to provide evidence of student thinking are important components of an ELA standard coded at a DOK Level 3. Furthermore, a standard coded at a DOK Level 3 requires a student to go beyond the required text and create essays by explaining, generalizing, and connecting ideas. Two examples of Grades 9-12 ELA standards coded at a DOK Level 3 are as follows:

Reading, Grades 9-10: 9-10.RI.7. Analyze various accounts of a subject told in different mediums (e.g., a person’s life story in both print and multimedia), determining which details are emphasized in each account.

Writing, Grades 11-12: 11-12.W.2.a. Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

Higher order thinking skills are essential skills that can be gained from an ELA standard coded at the highest DOK level, Level 4. Extended activities with multi-paragraph essays and the ability to apply, analyze, critique, create, and connect ideas with empirical evidence are also strong components of an ELA standard coded at a DOK Level 4. The distribution of standards

rated at a DOK Level 4 in the Grades 9-12 ELA CCSS was 2%. Two examples of Grades 9-12 ELA standards coded at a DOK Level 4 are as follows:

Writing, Grades 9-10: 9-10.W.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Reading, Grades 11-12: 11-12.RI.9. Analyze seventeenth-, eighteenth-, and nineteenth-century foundational U.S. documents of historical and literary significance (including The Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln's Second Inaugural Address) for their themes, purposes, and rhetorical features.

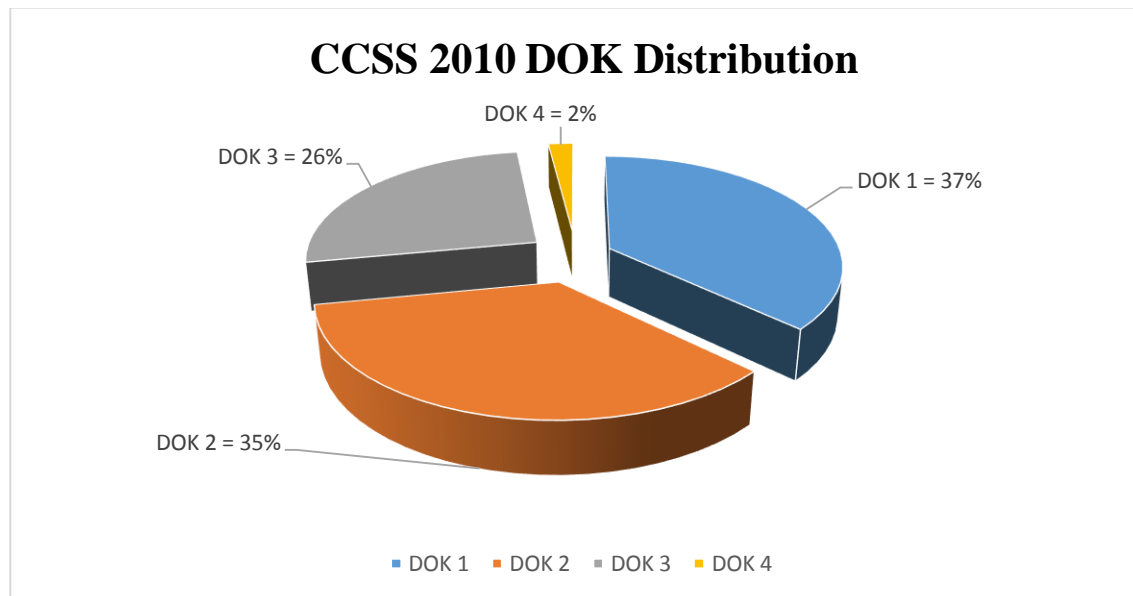


Figure 6. CCSS ELA DOK distribution.

Mathematics

The distribution of standards rated at a DOK Level 1 within the Grades 9-12 Mathematics CCSS was 19%. A mathematics standard rated at a DOK Level 1 requires basic recall of facts and definitions and performing basic one-step and algorithmic problems. See Appendix A for the

criteria for measuring mathematics levels. “Identify, recall, recognize, use, and measure” are some of the words that can be identified within a Mathematics standard rated at a DOK Level 1 (Webb, 2005). Two examples of Grades 9-12 Math CCSS coded at a DOK Level 1 are as follows:

Math, Grades 9-12 (The Real Number System): N.RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Math, Grades 9-12 (Congruence): G.CO.7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

The distribution of standards rated at a DOK Level 2 within the Grades 9-12 Mathematics CCSS was 71%. A mathematics standard rated at a DOK Level 2 requires students to use cognitive processing that is beyond simple recall or rote memorization. A DOK Level 2 mathematics standard has language that would allow for students to make judgments and observations on how to solve problems as well as classify and compare different data sets (Webb, 2005). Two examples of Grades 9-12 Math CCSS coded at a DOK Level 2 are as follows:

Math, Grades 9-12 (Vector and Matrix Quantities): N.VM.3 (+). Solve problems involving velocity and other quantities that can be represented by vectors.

Math, Grades 9-12 (Similarity, Right Triangles, And Trigonometry): G.SRT.11 (+). Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

The distribution of standards rated at a DOK Level 3 within the Grades 9-12 Mathematics CCSS was 10%. Mathematics standards that were rated at a DOK Level 3 require students to

use thinking with emphasis on reasoning, planning, and providing evidence of their cognitive processing. Creating a valid argument for complex problems and situations that could yield more than one right answer would be the type of language in a mathematics standard rated at a DOK Level 3.

Two examples of Grades 9-12 Math CCSS coded at a DOK Level 3 are as follows:

Math, Grades 9-12 (Seeing Structure in Expressions): A.SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.

Math, Grades 9-12 (Building Functions): F.BF.1.b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

A DOK Level 4 mathematics standard requires students to reach extended forms of creative and deeper complex thinking. A DOK Level 4 standard most likely has students using cognitive processes not for a single event, but over an extended time period. Higher order levels of thinking and the ability to make connections of a specific concept or event and critiquing, synthesizing, and designing experiments are all part of a mathematics standard rated at a DOK Level 4. The distribution of standards rated at a DOK Level 4 within the Grades 9-12 Mathematics CCSS was not found.

Business leaders are increasing their demands of students, mandating them to have critical 21st century skills such as creativity, strategizing complexity, adaptability, and innovation, as well as analytical and problem-solving skills (American Society for Training and Development [ASTD], 2009; Adobe, 2012; IBM Study, 2010; Kyllonen, 2012). Skills such as

creativity are amongst the most important competencies needed in increasing confidence in students and building our economy (IBM, 2010; Bronson & Merryman, 2010). ELA and Math standards that are low in cognitive complexity and depth of knowledge, a measure of creativity and 21st century skills, will make it difficult for students to develop essential 21st century skills that lead to creative and original thought (Gardiner, 1972, p. 327). On the other hand, standards high in complexity and depth of knowledge will enhance students' creative and extended levels of thinking by requiring them to “make multiple connections between several different key and complex concepts” (Gardiner, 1972, p. 327; Webb, 2005). States that adopted standards that are low in cognitive complexity will continue to play a role in making the United States lag behind other countries in 21st century competencies such as creativity, innovation, critical thinking, and problem solving (Kyllonen, 2012, p. 7).

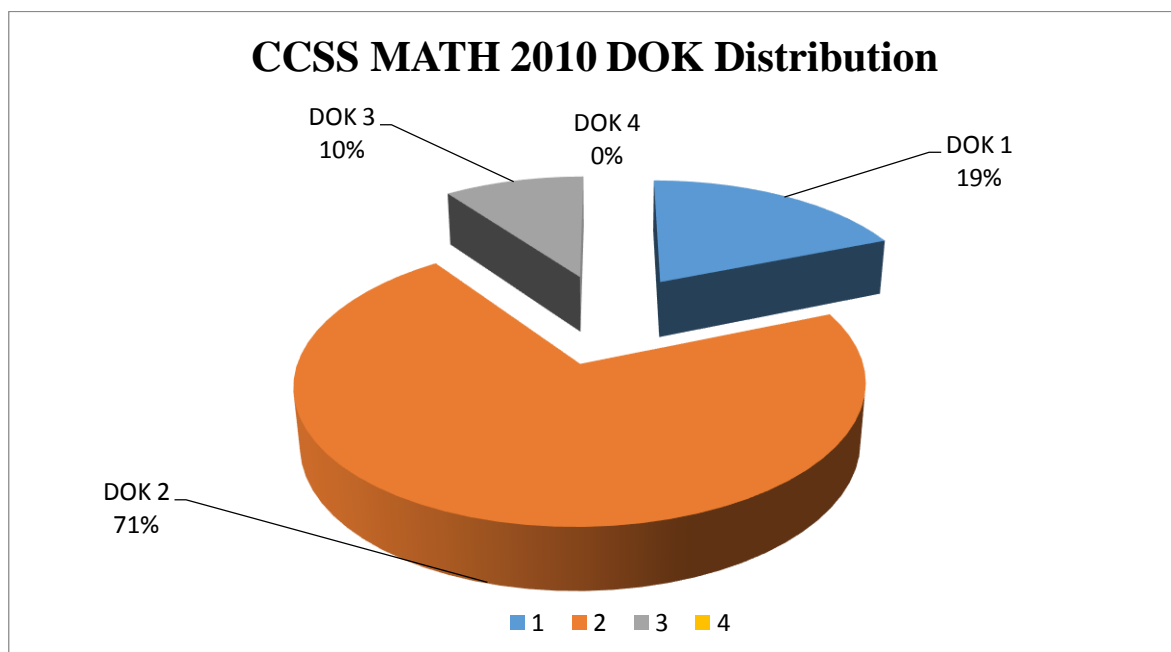


Figure 7. CCSS Math DOK distribution.

Findings for Research Question 2

Research Questions 2: To what extent is cognitive complexity, as defined by Webb's Depth of Knowledge, embedded in the New Jersey Core Curriculum Content Standards for Language Arts Literacy and Mathematics, Grades 9-12?

English Language Arts (ELA)

The second sets of standards coded in this study were the Grades 9-12 New Jersey Core Curriculum Content Standards (2008) for Language Arts Literacy and Mathematics. The NJCCCS had been used within New Jersey high schools since 1996 and were revised in 2008. New Jersey adopted the Common Core State Standards to replace the NJCCCS in 2010.

The distribution of DOK Level 1 in the Grades 9-12 ELA NJCCCS was 22%. Two examples of Grades 9-12 ELA NJCCCS coded at a DOK Level 1 are as follows:

Reading, Grades 9-12: 3.1.12.D.1. Read developmentally appropriate materials (at an independent level) with accuracy and speed.

Writing, Grades 9-12: 3.2.12.A.6. Review and edit work for spelling, usage, clarity, and fluency.

The distribution of standards coded at a DOK Level 2 within the Grades 9-12 ELA NJCCCS was 40%. A reading and writing standard coded at a DOK Level 2 requires a slightly higher cognitive processing of text and material than a Level 1. Comprehension and continued processing of readings along with unplanned speaking and simple writing tasks are some components of an ELA standard coded at a DOK Level 2. Two examples of Grades 9-12 ELA NJCCCS coded at a DOK Level 2 are as follows:

Reading, Grades 9-12: 3.1.12.A.2. Identify interrelationships between and among ideas and concepts within a text, such as cause-and-effect relationships.

Writing, Grades 9-12: 3.2.12.B.13. Write sentences of varying length and complexity, using precise vocabulary to convey intended meaning.

The distribution of standards coded at a DOK Level 3 in the Grades 9-12 ELA NJCCCS was 33%. Deeper cognitive processing, strategic thinking, and understanding are emphasized in ELA standards coded at a DOK Level 3. Two examples of Grades 9-12 ELA NJCCCS coded at a DOK Level 3 are as follows:

Reading, Grades 9-12: 3.1.12.E.1. Assess and apply reading strategies that are effective for a variety of texts (e.g., previewing, generating questions, visualizing, monitoring, summarizing, evaluating).

Writing, Grades 9-12: 3.2.12.B.3. Draft a thesis statement and support/defend it through highly developed ideas and content, organization, and paragraph development.

The distribution of standards rated at a DOK Level 4 in the Grades 9-12 ELA NJCCCS was 5%. A higher level and order of thinking is a key cognitive component within an ELA standard coded at the highest of DOK levels, Level 4. Extended activities with multi-paragraph essays and the ability to apply, analyze, critique, create, and connect ideas with empirical evidence are strong components of an ELA standard coded at a DOK Level 4. Two examples of Grades 9-12 ELA NJCCCS coded at a DOK Level 4 are as follows:

Reading, Grades 9-12: 3.1.12.G.2. Analyze how our literary heritage is marked by distinct literary movements and is part of a global literary tradition.

Writing, Grades 9-12: 3.2.12.D.2. Write a variety of essays (e.g., a summary, an explanation, a description, a literary analysis essay) that develop a thesis; creates an organizing structure appropriate to purpose, audience, and context; includes relevant information and

excludes extraneous information; makes valid inferences; supports judgments with relevant and substantial evidence and well-chosen details; and provides a coherent conclusion.

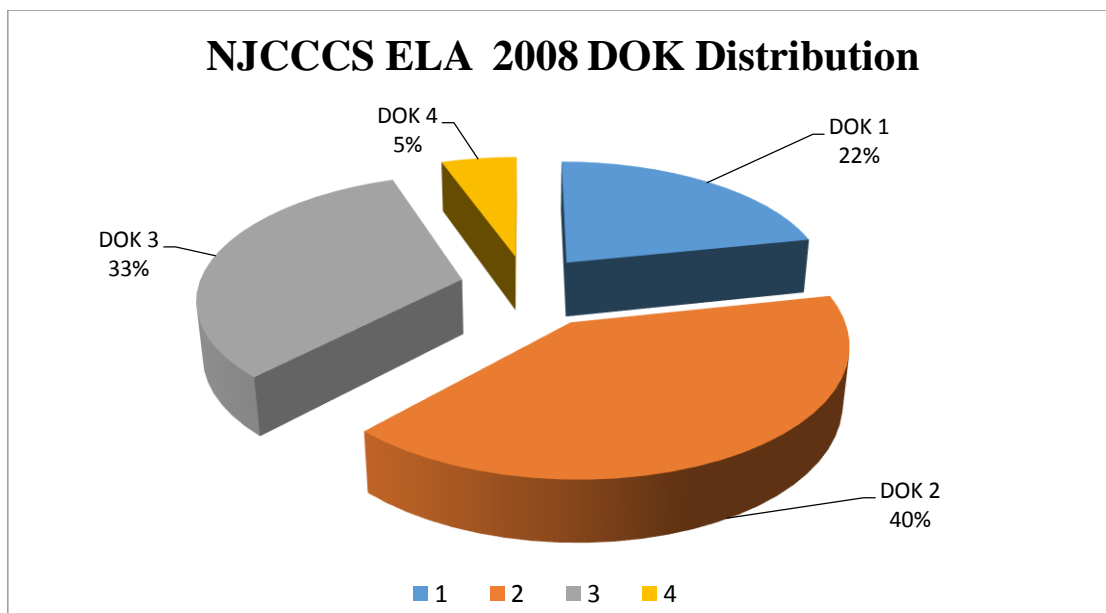


Figure 8. NJCCCS ELA DOK distribution.

Mathematics

The distribution of standards rated at a DOK Level 1 in the Grades 9-12 Mathematics NJCCCS was 8%. A mathematics standard rated at a DOK Level 1 requires basic recall of facts and definitions and performing basic one-step and algorithmic problems. “Identify, recall, recognize, use, and measure” are some of the words that can be identified within a mathematics standard rated at a DOK Level 1 (Webb, 2005). Two examples of Grades 9-12 Math NJCCCS coded at a DOK Level 1 are as follows:

Math, Grades 9-12 (Geometry and Measurement): 4.2.12 C.3. Find an equation of a circle given its center and radius and, given an equation of a circle in standard form, find its center and radius.

Math Grades 9-12 (Patterns and Algebra): 4.3.12 D.2. Select and use appropriate

methods to solve equations and inequalities.

- Linear equations and inequalities – algebraically
- Quadratic equations – factoring (including trinomials when the coefficient of x^2 is 1) and using the quadratic formula
- Literal equations
- All types of equations and inequalities using graphing, computer, and graphing calculator techniques

The distribution of standards rated at a DOK Level 2 within the Grades 9-12 Mathematics NJCCCS was 54%. A mathematics standard rated at a DOK Level 2 requires students to use cognitive processing that is beyond simple recall or rote memorization. A DOK Level 2 mathematics standard has language that would allow for students to make judgments and observations on how to solve problems as well as classify and compare different data sets (Webb, 2005). Two examples of Grades 9-12 Math NJCCCS coded at a DOK Level 1 are as follows:

Math, Grades 9-12 (Numbers and Numerical Operations): 4.1.12 A.2. Compare and order rational and irrational numbers.

Math, Grades 9-12 (Mathematical Processes): 4.5 F.4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).

The distribution of standards rated at a DOK Level 3 within the Grades 9-12 Mathematics NJCCCS was 28%. Mathematics standards that were rated at a DOK Level 3 required students to use strategic thinking with emphasis on reasoning, planning, and providing evidence of their cognitive processing. Creating a valid argument for complex problems and situations that could yield more than one right answer would be the type of language in a mathematics standard rated at a DOK Level 3.

Two examples of Grades 9-12 Math NJCCCS coded at a DOK Level 3 are as follows:

Math, Grades 9-12 (Patterns and Algebra): 4.3.12 C.2. Analyze and describe how a change in an independent variable leads to change in a dependent one.

Math, Grades 9-12 (Mathematical Processes): 4.5 A.2. Solve problems that arise in mathematics and in other contexts.

- Open-ended problems
- Non-routine problems
- Problems with multiple solutions
- Problems that can be solved in several ways

The distribution of standards rated at a DOK Level 4 within the Grades 9-12 Mathematics NJCCCS was 8%. A DOK Level 4 mathematics standard requires students to reach extended forms of creative and deeper complex thinking. A DOK Level 4 standard most likely has students using cognitive processes not for a single event, but over an extended time period. Higher order levels of thinking and the ability to make connections of a specific concept or event and critiquing, synthesizing, and designing experiments are all elements of a mathematics standard rated at a DOK Level 4. Two examples of Grades 9-12 Math NJCCCS coded at a DOK Level 4 are as follows:

Math, Grades 9-12 (Mathematical Processes): 4.5 B.3. Analyze and evaluate mathematical thinking strategies of others.

Math, Grades 9-12 (Data Analysis, Probability, and Discrete Mathematics): 4.4.12 A.2. Evaluate the use of data in real-world contexts.

- Accuracy and reasonableness of conclusions drawn
- Correlation versus causation

- Bias in conclusions drawn (e.g., influence of how data are displayed)
- Statistical claims based on sampling

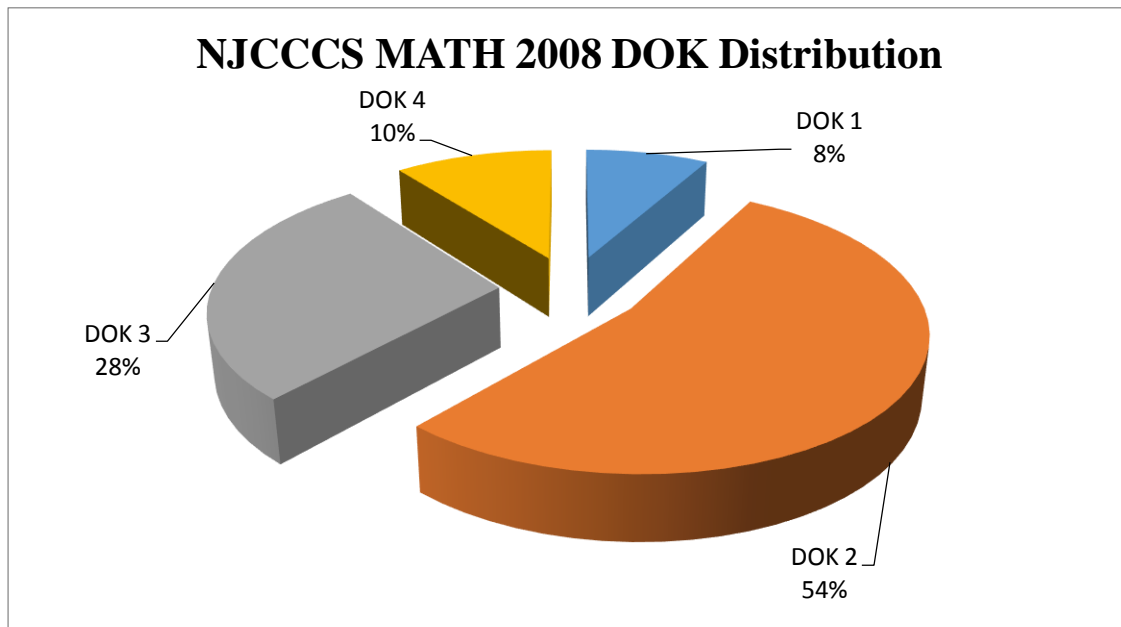


Figure 9. NJCCS Math DOK distribution.

Findings for Research Question 3

Research Question 3: What differences and similarities exist in cognitive complexity between the Common Core State Standards and New Jersey Core Curriculum Content Standards in English Language Arts/Language Arts Literacy and Mathematics Grades 9-12?

The third research question for this study sought to understand, compare, and contrast the distribution of cognitive complexity between the two sets of standards, the CCSS (2010) and the NJCCCS (2008). The data results are presented using a data array of graphs and charts.

English Language Arts (ELA)

Figure 10 shows the cognitive complexity distribution between the Grades 9-12 ELA CCSS and NJCCCS. The analyzed data indicate that the distribution of Grades 9-12 ELA CCSS rated at a DOK Level 1 was 15% more than the distribution of the Grades 9-12 ELA NJCCCS rated at a DOK Level 1. Of the ELA Grades 9-12 NJCCCS, 40% were rated at a DOK Level 2 compared with 35% of the Grades 9-12 ELA CCSS rated at a DOK Level 2. This indicates that the NJCCCS had a higher percentage (5%) of Grades 9-12 ELA standards rated at a DOK Level 2 (skills/concepts). The Grades 9-12 ELA NJCCCS had a DOK Level 3 distribution rating of 33%, 7% higher than the Grades 9-12 ELA CCSS (26%). The Grades 9-12 ELA NJCCCS also had a higher DOK Level 4 rating within their standards, with 5% of all standards rated at a DOK Level 4 compared with 2% of the Grades 9-12 ELA CCSS rated at a DOK Level 4.

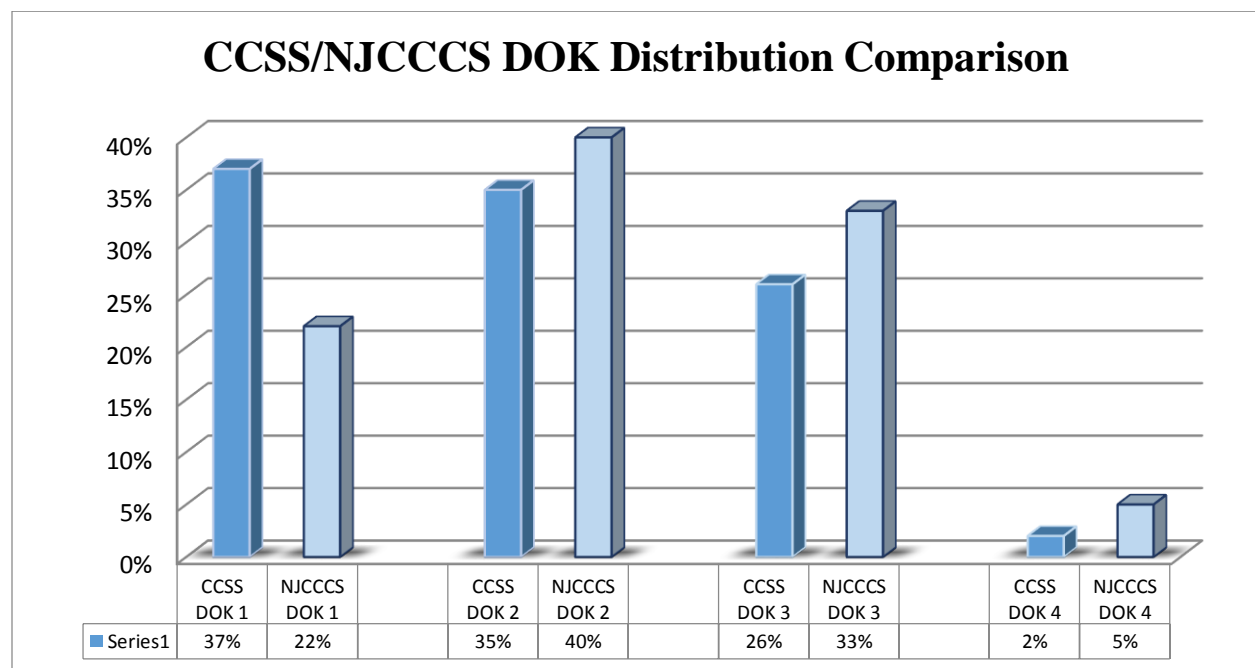


Figure 10. Comparison of cognitive complexity between the Grades 9-12 ELA CCSS and Grades 9-12 ELA NJCCCS.

In order to reach extended levels of creative thinking, standards that are rated high in cognitive complexity—that is, DOK Level 3 and Level 4 strategic and extended levels of thinking—needed to be reached. Standards rated at DOK Levels 3 and 4 have the potential of allowing students to reach extended levels of creative thinking as compared to DOK Levels 1 and 2. Figures 11 and 12 show the cognitive complexity distribution within each set of standards. Seventy-two percent of the Grades 9-12 ELA CCSS were rated at the lower DOK Levels 1 and 2, which involve basic recall and use of simple skills as compared to 62% of the NJCCCS rated at the lower DOK Levels 1 and 2. Twenty-eight percent of the Grades 9-12 ELA CCSS were rated at the higher levels of DOK 3 and 4, strategic and extended forms of thinking, compared with 38% of the Grades 9-12 ELA NJCCCS rated at the higher levels of DOK 3 and 4.

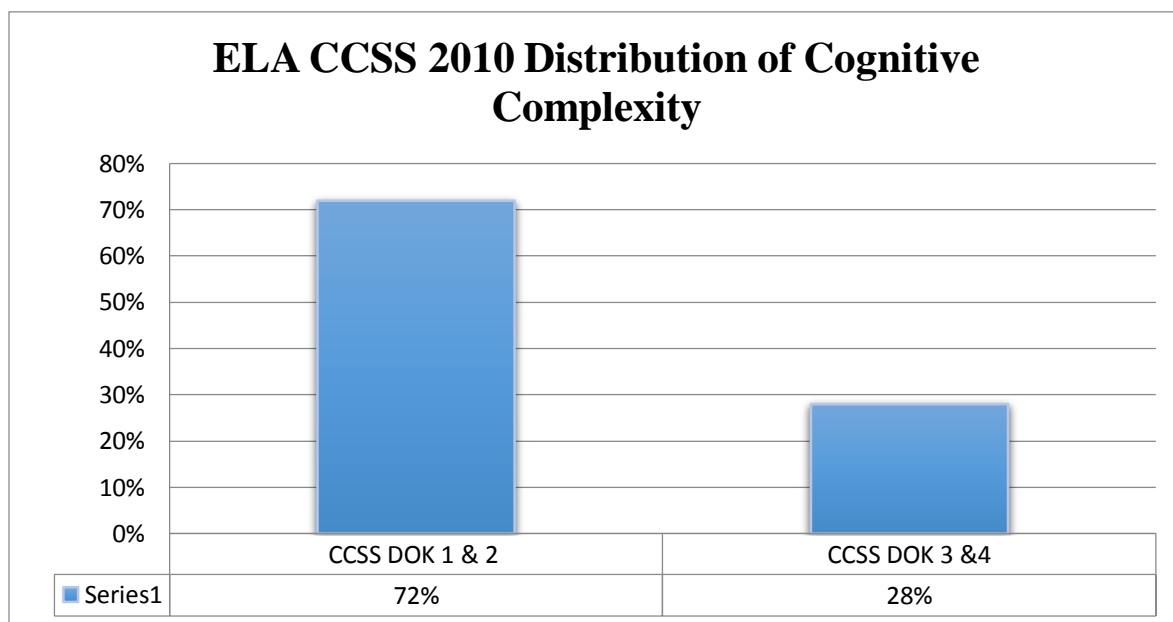


Figure 11. Distribution of cognitive complexity within the Grades 9-12 ELA CCSS.

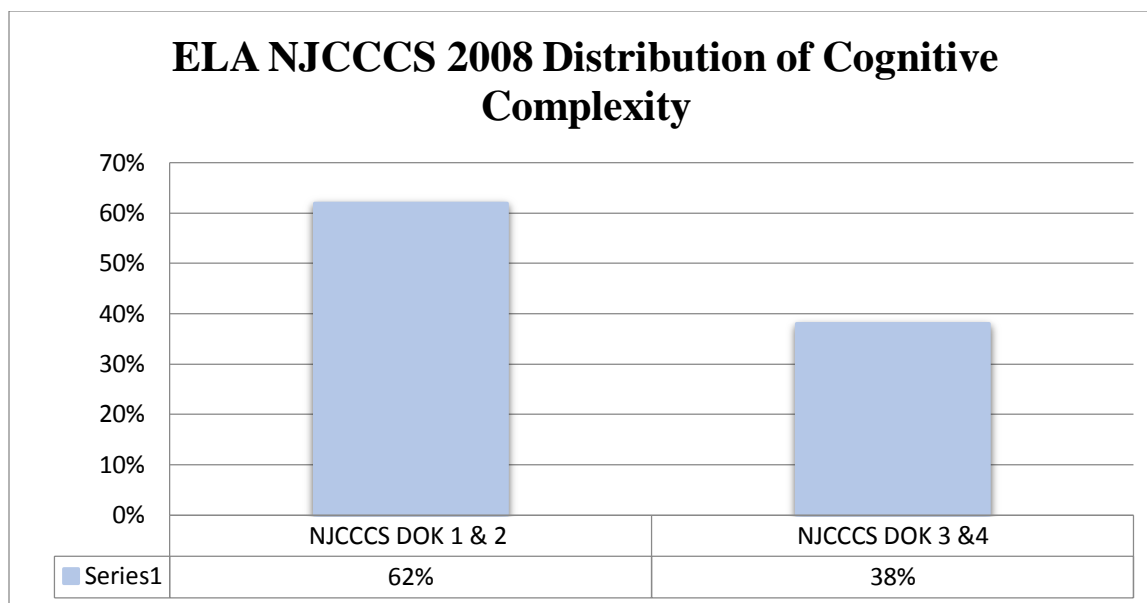


Figure 12. Distribution of cognitive complexity within the Grades 9-12 ELA NJCCCS.

Figure 13 displays the DOK distribution in ELA between the two sets of standards (Grades 9-12 ELA CCSS and NJCCCS). The Grades 9-12 ELA CCSS are lower in cognitive complexity, with a combined DOK Level 1 and 2 of 72 %, as compared with the combined 62% of DOK Level 1 and 2 coded within the Grades 9-12 ELA NJCCCS. The Grades 9-12 ELA NJCCCS provide students with the potential of reaching higher levels of cognitive complexity, with a combined 38% rated at a DOK Level 3 and 4 as compared to 28% of the Grades 9-12 ELA CCSS rated at a DOK Level 3 and 4.

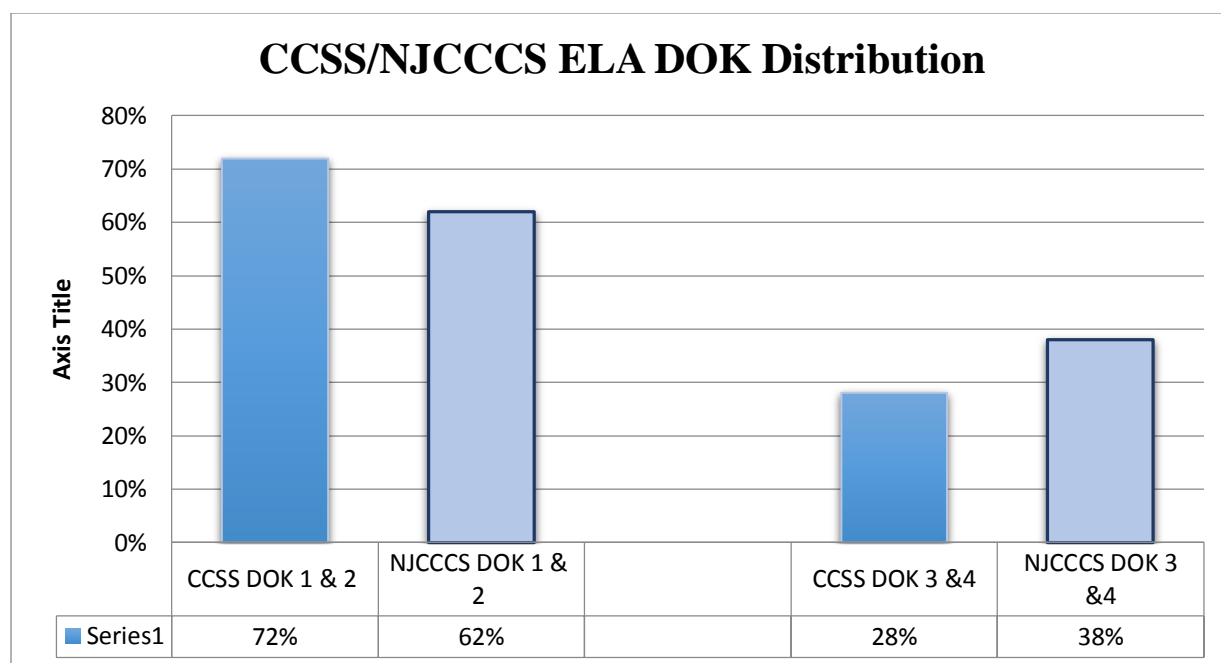


Figure 13. Grades 9-12 ELA CCSS/NJCCCS DOK distribution comparison.

Mathematics

Figure 14 presents the cognitive complexity distribution between the Grades 9-12 CCSS and Grades 9-12 NJCCCS in Mathematics. The data indicates that the distribution of DOK Level 1 thinking amongst the Math Grades 9-12 CCSS was 11% more (19%) than the distribution of DOK Level 1 within the Grades 9-12 NJCCCS (8%). The Grades 9-12 CCSS Math standards had a higher percentage of standards (19%) rated at a DOK Level 1, as compared to the Grades 9-12 Math NJCCCS. Of the Math Grades 9-12 CCSS, 71% were rated at a DOK Level 2, while 54% of the Grades 9-12 Math NJCCCS were rated at a DOK Level 2. The Grades 9-12 Math NJCCCS had a DOK Level 3 rating of 28%, which was 18% more than the CCSS DOK Level 3 rating of 10%. The Grades 9-12 Math NJCCCS also had a higher DOK Level 4 rating of their standards, with 10% of all standards rated at a DOK Level 4, as compared to 0% of the Grades 9-12 Math CCSS rated at a DOK Level 4.

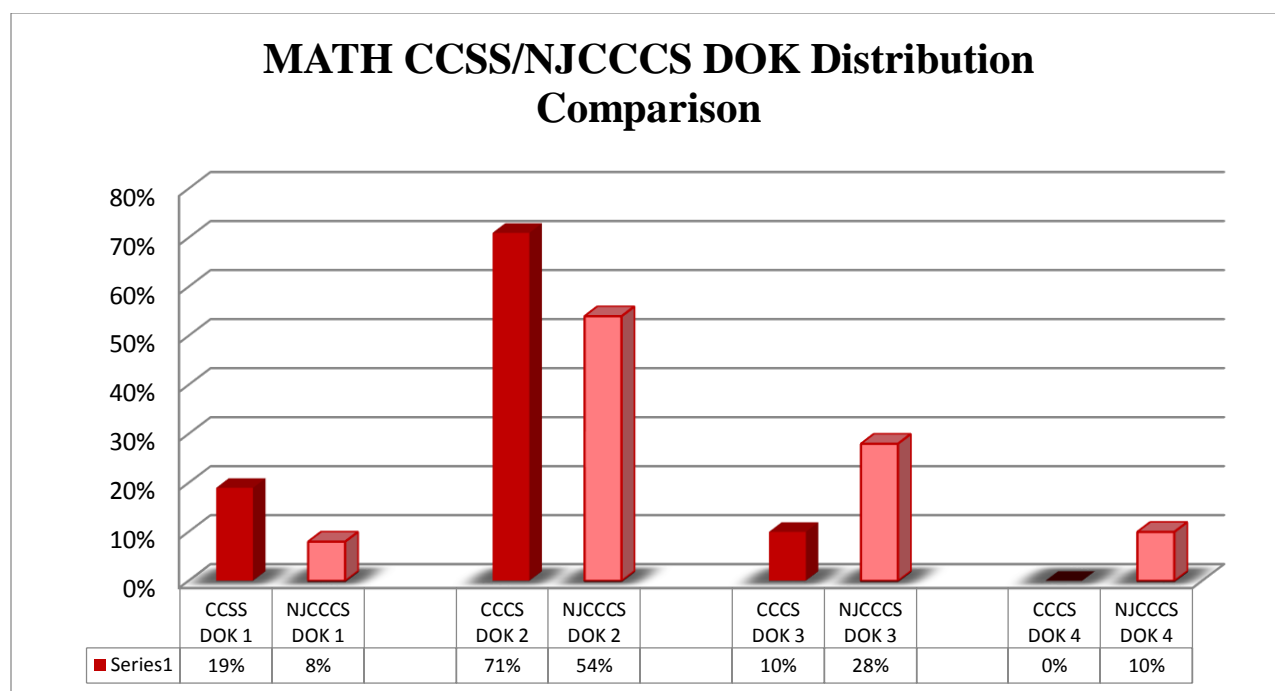


Figure 14. Comparison of cognitive complexity between the Grades 9-12 Math CCSS and Grades 9-12 Math NJCCCS.

In order to reach extended levels of creative thinking, standards that are rated high in cognitive complexity—that is, a DOK Level 3 and Level 4 strategic and extended levels of thinking—needed to be reached. Figures 15 and 16 provide a visual of the cognitive complexity distribution within each set of math standards. When DOK levels are grouped together, the reader can get a better understanding of the distribution of lower (DOK Levels 1 and 2) versus higher (DOK Levels 3 and 4) levels of thinking within the standards. Of the Grades 9-12 Math CCSS, 90 % were rated low in cognitive complexity, DOK Levels 1 and 2. DOK Levels 1 and 2 standards involve basic recall and use of simple problem-solving skills. Ten percent of the 9-12 Math CCSS were rated high in cognitive complexity, DOK Levels 3 and 4, which involve strategic and extended forms of thinking.

Within the Grades 9-12 Math NJCCCS, 62% of the standards provide students with the opportunity of reaching the lower DOK Levels 1 and 2 of thinking, which involve basic recall

and use of simple problem-solving skills. Of the Grades 9-12 Math NJCCCS, 38% were rated at higher complexity levels of thinking, DOK Levels 3 and 4, which involve strategic and extended forms of thinking.

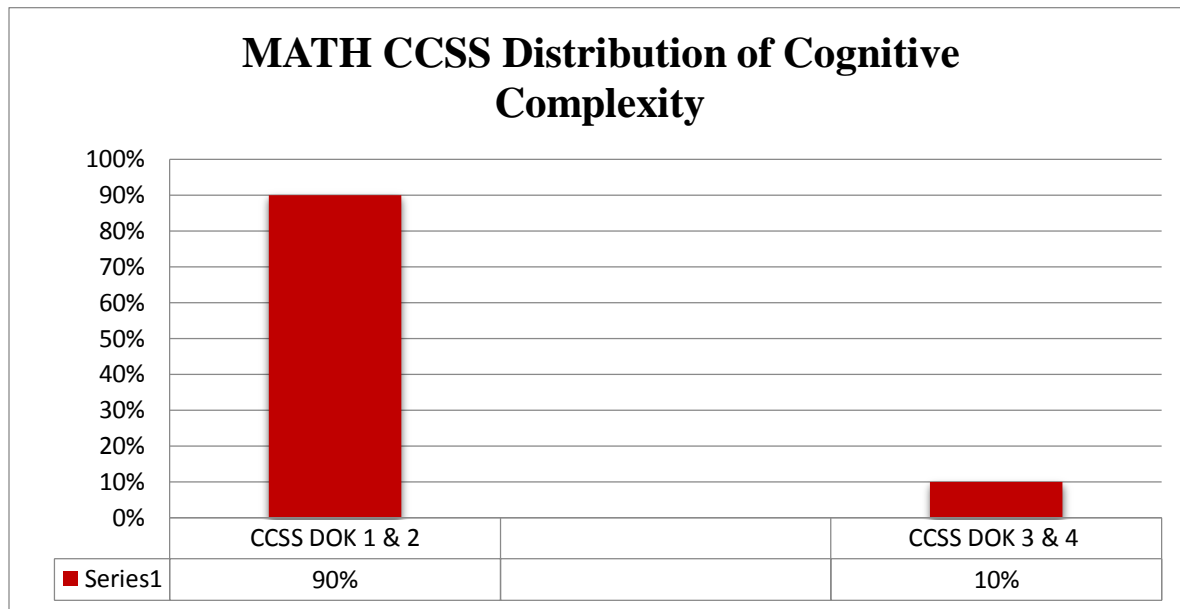


Figure 15. Distribution of cognitive complexity within the Grades 9-12 Math CCSS.

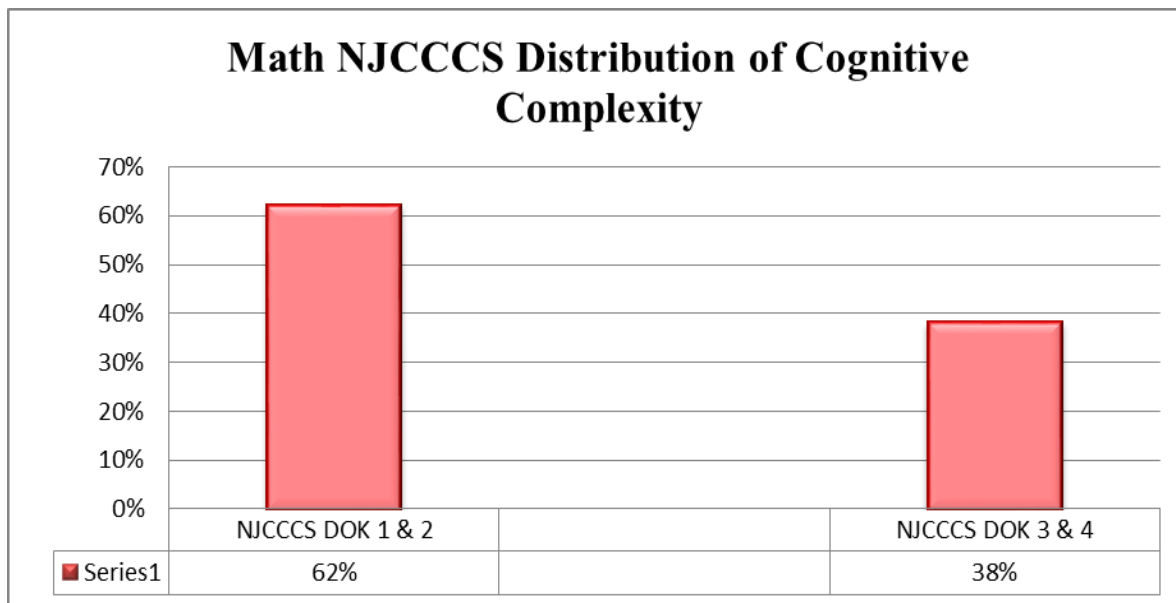


Figure 16. Distribution of cognitive complexity within the Grades 9-12 Math NJCCCS.

Figure 17 provides a visual of the DOK distribution in Math when the two sets of standards (Grades 9-12 Math NJCCCS and CCSS) are placed side by side. The Grades 9-12 Math CCSS are lower in cognitive complexity with a DOK Level 1 and 2 distribution of 90 %, as compared to 10% of DOK Level 1 and 2 standards found in the Grades 9-12 Math NJCCCS. The Grades 9-12 Math NJCCCS provide students with the potential of reaching higher levels of cognitive complexity within their standards, as compared to the Grades 9-12 Math CCSS, with a combined DOK Level 3 and 4 percentage of 38%, as compared to a combined DOK Level 3 and 4 of 10% within the Grades 9-12 Math CCSS.

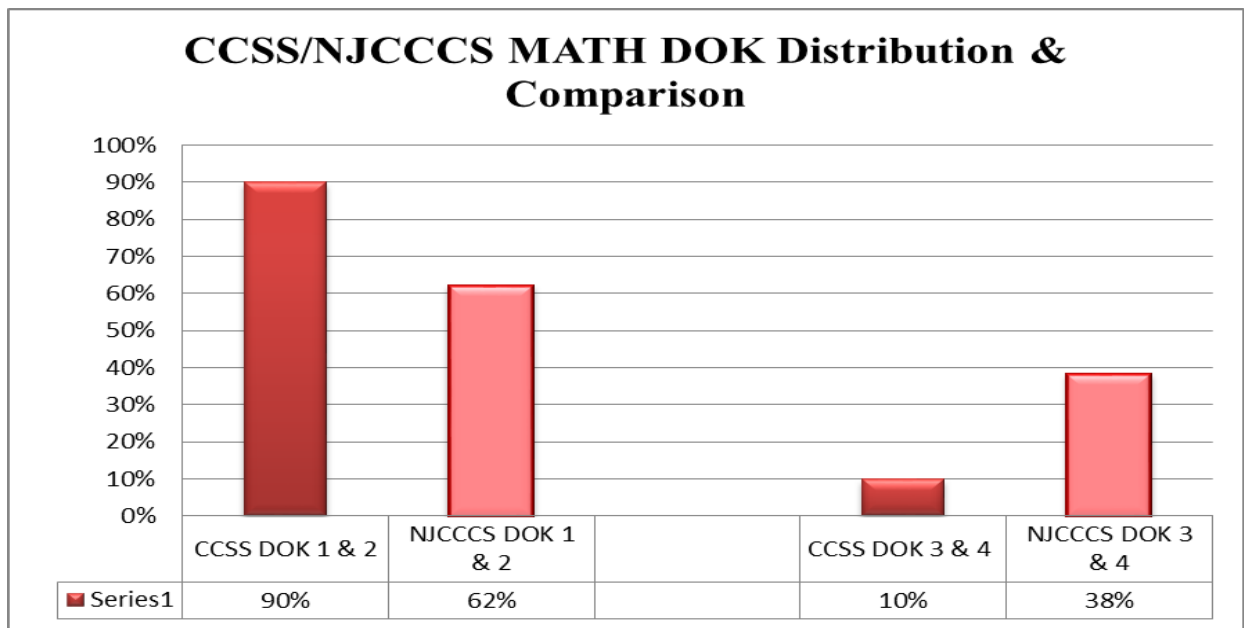


Figure 17. Grades 9-12 Math CCSS/NJCCCS DOK distribution comparison.

Conclusion

The purpose of this study was to assess the cognitive complexity of the new Grades 9-12 Math and English Language Arts Common Core State Standards (CCSS) as compared to the cognitive complexity within the Grades 9-12 Math and English Language Arts New Jersey Core Curriculum Content Standards (NJCCCS) using Webb’s Depth of Knowledge framework. It was hypothesized that the higher the DOK level, the higher the standards are in cognitive complexity. The more cognitively complex a standard is, the more creativity and innovation—key components of 21st century skills—within curricula, teaching, and assessments will be created from the standards. The data in this chapter provided a descriptive comparison and assessment of cognitive complexity distribution between the two sets of standards. In response to the three research questions, data analysis revealed specific distribution percentages of cognitive complexity, coded as Depth of Knowledge (DOK) levels, within each set of standards. The

major findings were identified as the CCSS was compared to NJCCCS, using the DOK framework:

1. When using DOK as an analytic framework, the findings indicate that overall both the Grades 9-12 ELA and Math NJCCCS (2008) were rated at a higher level of cognitive complexity, as compared to the Grades 9-12 ELA and Math CCSS (2010).
2. The Grades 9-12 ELA NJCCCS were rated at an overall higher percentage of DOK Levels 3 and 4 than were the Grades 9-12 ELA CCSS.
3. The Grades 9-12 Math NJCCCS were rated at an overall higher percentage of DOK Levels 3 and 4 than were the Grades 9-12 Math CCSS.
4. The Grades 9-12 ELA CCSS had a higher percentage of lower rated standards, DOK Levels 1 and 2, as compared to the Grades 9-12 ELA NJCCCS.
1. The Grades 9-12 Math CCSS had a higher percentage of lower rated standards, DOK Levels 1 and 2, as compared to the Grades 9-12 Math NJCCCS.

Chapter V includes a summary of the study, brief comments on the study findings as they relate to the research questions, implications for policy and practice, and future research recommendations.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Summary, Overview, Discussion, and Restatement of the Problem

In this chapter, I provide a summary of the study, including restatement of the problem, brief comments on the findings as they relate to the research questions, as well as a conclusion, implications for policy and practice, and recommendations for future research. The purpose of this qualitative content analysis study was to describe and compare the distribution of cognitive complexity in the English Language Arts and Math Common Core State Standards with New Jersey Core Curriculum Content Standards in Grades 9-12. Limited research exists that compare the old Grades 9-12 New Jersey standards (NJCCCS) in ELA and Math with the newer Grades 9-12 ELA and Math Common Core State Standards (CCSS) adopted by New Jersey. This is especially true when comparing standards based on creativity and 21st century cognitive complexity.

Webb's Depth of Knowledge (DOK) was utilized as the conceptual framework for this study. Webb's DOK consists of four levels of knowledge: Level 1, recall, and Level 2, skills and concepts, are levels that require basic knowledge recitation and comprehension. No creative thinking is taking place in DOK Levels 1 and 2. Webb's Depth of Knowledge Level 3, strategic thinking and complex reasoning, and Level 4, extended levels of thinking, are the levels where students are able to reach deeper, analytical, and more strategic/extended levels of thinking and complex reasoning. This is where researchers argue that creativity begins. This is in large contrast to Webb's DOK Levels 1 and 2, which ask students to complete basic recall and application of skills and concepts (Webb, 2005).

There is a lack of research on cognitive complexity, using Depth of Knowledge as a measure of cognitive complexity as well as a means to assess academic creativity within educational standards. As a neuroscientist, Heilman (2005) states that “all creativity involves making connections between disparate ideas that seem to have no connection with one another” (as cited in Holland, 2009, p. 274). The language, reasoning, and understanding of ideas and their cognitively complex connection to current and past acquired knowledge allow the mind to create and innovate. The NEA (2010) recognizes the importance of creativity and innovation in today’s public schools and advocates for the creation of a robust curriculum that infuses these skills in order to prepare students for the demands of a 21st century workforce (p. 24). Critics of the CCSS such as Zhao (2012) and Tienken and Orlich (2013) have argued that a prescribed curriculum could do more harm than good to students’ creative, critical, and analytical thinking. Burlein and Stotsky (2012) have argued that the ELA CCSS might be limiting students’ college readiness and career development based on there being more emphasis on informational text rather than the great works of literature. There is a gap in the literature regarding studies that use cognitive complexity, based on Webb’s DOK, to assess the creative, innovative, and strategic potential of an educational objective. The present study addresses this void as well as the cognitive complexity within the ELA and Math CCSS and NJCCCS. The present study can help policy makers understand if the newly adopted CCSS are more cognitively complex than the previous standards. This study sought to answer the following questions: Does the CCSS provide students with more divergent and extended forms of creative thinking, such as creativity, adaptability, and strategizing as compared to the NJCCSS, or is the CCSS mainly convergent in nature, preventing students from reaching extended forms of creative thinking?

Summary of Methodology

Webb's Depth of Knowledge is the most closely linked to cognitive complexity, a measure of 21st century skills such as creativity and innovation. The present study employed a qualitative content analysis method to code the standards. Deductive category application was used to connect Webb's Depth of Knowledge framework to the existing CCSS and NJCCSS (Mayring, 2000). Each Depth of Knowledge level represents a specific level of cognitive complexity. The higher the DOK level of a standard, the more cognitive complexity within the standard. The higher the cognitive complexity of a standard, the more creativity and innovation embedded into the standard. Each standard was rated on a 1-4 Depth of Knowledge level based on Webb's Depth of Knowledge methodology. The present study involved two analysts who were trained using Webb's Depth of Knowledge methodology, assigning a DOK level code to each of the standards and then comparing their data and findings, thus increasing inter-rater reliability (Merriam, 2009, p. 216). The method used was a "double-rater read behind consensus model," which proved to be an effective "reliability check" when coding standards (Miles, Huberman, & Saldaña, 2014, p. 84; Sato, Lagunoff, & Worth, 2011, p. 11). In order to ensure credibility, the findings of this study were compared to previous studies that had been successful in coding the Common Core State Standards, using Webb's Alignment Tool for alignment purposes. Content clustering or grouping of standards, similar to Sato et al.'s (2011) study was also used in this study when coding standards.

Discussion of Findings

The complex web of divergent thinking needs to be incorporated into the teaching of essential 21st century skills in order to allow the students and teacher to arrive at different "unrelated possibilities before settling on one answer" (Holland, 2009, p. 285). An intended curriculum, based on content standards that are low in cognitive complexity and depth of

knowledge will make it difficult for students to experience an enacted curriculum designed to develop essential 21st century skills that lead to creative and original thought (Gardiner, 1972, p. 327). On the other hand, an intended curriculum based on content standards that are high in complexity and depth of knowledge will allow students to reach creative and extended levels of thinking by preparing them to “make multiple connections between several different key and complex concepts” (Gardiner, 1972, p. 327; Webb, 2005).

The findings of this study centered on three primary research questions:

Research Question 1

To what extent is cognitive complexity, as defined by Webb’s Depth of Knowledge, embedded in the Common Core State Standards for English Language Arts and Mathematics, Grades 9-12?

This research question is important not only for the state of New Jersey, but for all 45 states and the District of Columbia that adopted the CCSS to replace their state’s content standards. As discussed in Chapter I, if deeper levels of cognitive demand are absent from an intended curriculum and content standards involve basic skills and repetition (DOK Levels 1 and 2) rather than complex and strategic levels of learning (DOK Levels 3 and 4), efforts to help students acquire creative and original thinking skills can be jeopardized (Runco & Chand, 1995, p. 245). All Grades 9-12 ELA CCSS were analyzed and coded, using Webb’s DOK methodology, with the exception of Grades 6-12 Literacy in History/Social Studies, Science, and Technical Subjects, which were beyond the scope of this study as the Grades 9-12 ELA NJCCCS did not have comparable standards.

Seventy two percent (72%) (37% of DOK Level 1 and 35% of DOK Level 2) of the Grades 9-12 ELA Common Core State Standards were rated at a Depth of Knowledge Level 1

and 2. DOK Levels 1 and 2 describe cognitive processes that are considered low in depth of knowledge complexity. Twenty eight percent (28%) of the Grades 9-12 ELA CCSS were rated high in complexity, a DOK Level 3 and 4. This suggests that critical 21st century college and career readiness skills such as creativity, critical thinking, innovation, analytical thinking, collaboration, and problem solving are largely absent from Grades 9-12 ELA CCSS (72%). With only 28% of the Grades 9-12 ELA standards coded at a higher complexity level, it casts doubt on whether the Grades 9-12 ELA CCSS are preparing high school students with creative, strategic, and innovative thinking skills.

The complexity distribution for the Grades 9-12 Math CCSS was extremely low. Ninety percent (90%) of the Grades 9-12 Math CCSS were rated at a DOK Level 1 and 2 (19% for DOK Level 1 and 71% for DOK Level 2). Although the distribution skewed more towards a DOK Level 2, skills and concepts, the potential for students to reach complex and higher order levels of thinking from the Grades 9-12 CCSS math intended curriculum would be considered to be very low. Only 10% of the Grades 9-12 Math CCSS were rated to be high in complexity. Of the 10% (10% for DOK Level 3), not one standard was rated at a DOK Level 4. Based on these distribution percentages, it appears that the Grades 9-12 Math CCSS fail to provide high school students with the opportunity to reach and acquire extended forms of complex creative and critical thinking skills which are essential 21st century competencies in mathematics.

Research Question 2

To what extent is cognitive complexity, as defined by Webb's Depth of Knowledge, embedded in the New Jersey Core Curriculum Content Standards for English Language Arts and Mathematics, Grades 9-12?

Similar to the Grades 9-12 ELA CCSS, a high percentage (62%) of the Grades 9-12 ELA NJCCCS were rated low in complexity (DOK Level 1 = 22% and DOK Level 2 = 40%). The Grades 9-12 ELA NJCCCS had a DOK Level 3 and Level 4 distribution of 38% (DOK Level 3=33% and DOK Level 4=5%). Although unanticipated, the distribution of cognitive complexity within the Grades 9-12 Math NJCCCS was identical to the Grades 9-12 ELA NJCCCS, with 62% categorized at DOK Levels 1 and 2 (DOK Level 1=8% and DOK Level 2 =54%). Although DOK Levels 1 and 2 were higher for the Grades 9-12 Math NJCCCS, students still had a 38% chance (DOK Level 3=28% and DOK Level 4=10%) of reaching higher and extended forms of strategic, creative, and critical thinking and developing complex problem-finding and problem-solving skills, essential 21st century competencies for college and career-readiness.

Research Question 3

What differences and similarities exist in cognitive complexity between the Common Core State Standards and New Jersey Core Curriculum Content Standards in English Language Arts and Mathematics for Grades 9-12?

Critical thinking, strategizing, problem solving, creativity, and innovation are skills necessary for students to succeed in the 21st century (Trilling & Fadel, 2009, pp. 96-97). An intended curriculum that is low in complexity and depth of knowledge will make it difficult for students to develop necessary 21st century competencies that lead to creative and original thought (Gardiner, 1972, p. 327).

Although both the Grades 9-12 ELA CCSS and Grades 9-12 ELA NJCCCS were low in cognitive complexity, the Grades 9-12 ELA NJCCCS included a higher percentage of standards at Levels 3 and 4, 38% as compared to 28% of the CCSS Grades 9-12 in ELA. This higher

percentage of complexity standards within the Grades 9-12 ELA NJCCCS raises some questions for New Jersey high school administrators and the current initiative to prepare New Jersey students to be college and career ready if that readiness includes being more skilled at thinking creatively, strategically, and innovatively. The results of this study provide evidence that New Jersey high school students were provided potentially more opportunities to be exposed to curricula that included deeper levels of critical and creative thinking under the old standards as compared to the newly adopted CCSS for Grades 9-12 English and Language Arts standards. In addition to the 10% difference, only 2% of the Grades 9-12 ELA Common Core intended curriculum provide the potential for the enacted curriculum to reach an extended Depth of Knowledge Level 4, which includes creativity, innovation, and critical thinking compared with 5% of the previous Grades 9-12 ELA NJCCCS, rated a DOK Level 4.

Although both the Grades 9-12 math CCSS and Grades 9-12 math NJCCCS were low in cognitive complexity, the Grades 9-12 math NJCCCS were rated 28% higher in Depth of Knowledge Levels 3 and 4, the levels where creativity, critical thinking, and innovation occur, than the newer adopted Grades 9-12 math CCSS (38% versus 10%). This result indicates that 90% of the Grades 9-12 math CCSS were coded to be a DOK Level 1 and 2 as compared to 62% of the Grades 9-12 math NJCCCS coded a DOK Level 1 and 2. Similar to the ELA standards, the higher percentage of complexity within the Grades 9-12 Math NJCCCS also raises some questions on whether or not current New Jersey high school students are truly being prepared to be college and career ready. The results of this study provide evidence that New Jersey high school students were provided with much deeper levels of critical and creative thinking under the old math standards (NJCCCS) as compared to the newly adopted math CCSS for Grades 9-12.

Limitations

Several limitations should be noted regarding this study. Although the two coders were trained using Webb's DOK coding protocol, the results of this study, like other standards classification studies (i.e., Niebling, 2012; Porter et al., 2011; Florida State University CPALM, 2012) were subjective based on the coders' experience and areas of expertise. In addition, the results of this study are limited to the instrument, Webb's DOK framework, used for this study, as well as the documents, the Grades 9-12 ELA and Math CCSS and NJCCCS. The results of this study will enable readers to better understand the *intended* curriculum; that is, what students "are supposed to learn," not the *enacted* curriculum, what students actually have the opportunity to learn, or the *assessed* curriculum, what students are assessed on (Niebling, 2012). Although some might see this as a limitation, it could also be a strength of the study. If the intended curriculum, the foundation for the enacted and assessed curriculum, is based on weak standards categorized by low levels of cognitive complexity and a lack of 21st century skills, then the entire structure upon which an enacted and assessed curriculum is built will be weak in cognitive complexity and 21st century learning outcomes. Additional limitations include the fact that this study limited the comparison of cognitive complexity within the CCSS to only one state, New Jersey, even though 45 states and the District of Columbia adopted the CCSS. Also, the results are limited to only two subject areas, ELA and Math, and only Grades 9-12.

In addition, this study, similar to Sato, Lagunoff, and Worth's (2011) study deviated from Webb's recommendation of using at least five coders. Although some might also see this as a limitation, the addition of using "a double-rater read behind" process that allowed ongoing consensus discussions to occur as well as content clustering for all standards and substandards,

and single DOK coding of all standards and substandards increased the validity and reliability of this study (Sato, Lagunoff, & Worth, 2011, p. 11).

Recommendations for Further Research

“No Policy, even a low-cost one, should be adopted if it is unlikely to be effective (Fowler, 2009, p. 264). The results of this study could potentially begin a discussion at the local, state, and national level on the expedited adoption of not only the CCSS, but all new educational standards, initiatives, programs, and assessments if one or more of the stated goals of such adoption was to increase creative, strategic, and innovative thinking. The results of this study could also potentially have implications for stakeholders invested in ensuring New Jersey public schools remain the most competitive nationally and globally. The intent of this study was not to start a debate on who was right and who was wrong in the adoption of the Common Core State Standards, but to provide some empirical evidence on how the CCSS and NJCCCS high school standards in Mathematics and English Language Arts compare in terms of their support of creative, strategic, and innovative thinking. Based on the results of this study, I would recommend that policy makers in New Jersey and in all states that adopted the Common Core State Standards create a task force to assess the creative potential of the CCSS as compared to the previous standards. This task force would be taking an important step in ensuring the United States’ creativity gap continues to narrow. Since the CCSS are low in Webb’s DOK Levels 3 and 4, students exposed to these standards might have a difficult time in formulating creative and purposeful ideas or solving ill-structured problems that do not have a correct answer (Gardiner, 1972, p. 327).

The task forces would determine whether it was necessary to adopt the CCSS for the express purpose of increasing the cognitive complexity of their school curriculum. Due to the

financial investment states have already made in implementing the Common Core State Standards, I would not recommend a full withdrawal from the CCSS, but a sensible and calculated plan of action, ensuring that supplementary programs, training, and materials that allow students to reach extended forms of thinking is being implemented within their high school curriculum. Supplementary curriculum materials should be beyond CCSS aligned or adopted materials and resources and must include activities, programs, and curricula that would ensure schools are truly preparing high school students for the demands of a 21st century college and career world.

Implications/Recommendations for Policy

1. Return local control to districts in order to provide students with a democratic education free from one-size-fits-all standards.

The Assessing and Teaching of 21st Century Skills study (2010) defined skills for living in the world—such as citizenship, life and careers, and personal and social responsibility—as one of four critical 21st century skills (Cisco et al., 2010). With the strong focus on standardization and testing, students could be at risk of not gaining these democratic 21st century skills.

McGuinn (2006) highlights how local control of school districts has decreased “to a degree unprecedented in the country’s history, and the federal government’s influence over education has never been greater” (p. 1). Howe and Meens (2012) describe local control as “the power of communities, made up of individuals bound together by common geography, resources, problems, and interests to collectively determine the policies that govern their lives” (p. 2).

Hiillmiin (1964) emphasized the importance of creativity and its connection to the local environment through Dewey’s (1958) theory stating, “The creative act itself is a dynamic interaction between the person and his environment” (p. 273). I recommend, based on the

results of this study and the existing literature and theories, that state policy makers give local school districts the flexibility of creating a localized curriculum that meets the demands of the students and their families invested in that specific district. “Aiken’s (1942) landmark Eight-Year Study already demonstrated that curriculum can be an entirely locally developed project and still produce better results than traditional curricular programs” (Tienken, 2011, p. 14). Baines confirmed that any type of standardization of education can harm a democratic education system. “Democracy should not be taken for granted” and leaders should continue to allow it to define and “characterize the whole life of their schools” (Aiken, 1942, p. 9). A federal or state controlled education system will not have the flexibility to allow for a democratic local education (Howe & Meens, 2012, p. 9).

According to Fowler (2012), a localized curriculum that is “closest to the taxpayers/consumers receiving them” could prove to be a more efficient and effective system of education (Koret Task Force, 2012, p. 5). Historical policy decisions that “forced schools to change from loosely-organized, largely locally-controlled, child-centered schools to tightly-governed, centrally-controlled, outcomes-focused schools” proved to be less effective than a more democratic system of education (Baines, 2011, p. 4). History tells us that this “Pollyanna approach to policy making” did not work before and can have similar, if not harsher, consequences in our present day education environment. (Tienken, 2011, p. 11). “A national curriculum would violate the history of local control in education” (Dorn, 2013, par. 3). Policy makers need to see education as the Eight-Year-Study saw it, “as the total experience with which the school deals with educating young people” (qtd. in Tanner & Tanner, 2007, p. 109). The historical significance of Dewey’s experiential learning is absent in a national-curriculum-for-all approach (Tanner & Tanner, 2007). “By its nature, democracy presumes the value of local

control. Democracy trusts in the people to rule themselves, based on their collective judgment, freed from externally imposed dictates” (Howe & Meens, 2012, p. 2).

The United States has always valued local control of its schools, although traditional schooling in the United States could sometimes be far from autonomous. PISA (2009) stresses how schools with greater autonomy and control of their curriculum will see a direct correlation with academic improvement. When districts decentralize, schools become more compatible with neighborhood traditions, needs, and values (Cibulka, 1991). Leslie R. Jacobs and Paul Vallas (2009) contend that autonomy, control over one’s own budget, and flexibility in staffing are all important parts of increasing academic achievement. (Kohn, 2010). Decentralization and autonomy are essential components to producing and offering students a democratic education (Howe & Meens, 2012). A curriculum that is developed at the local level will still include the important components of mathematics and language arts, but just as important it will allow local curriculum developers to develop a program that addresses the unique 21st century skills and problems of the community and students which it services (Dewey, 1938; Howe & Meens, 2012).

2. Learn from the *Cardinal Principles of Secondary Education* and remove one-size-fits-all standards mandates and replace with more holistic targets.

“The rise of what is called new education and progressive schools is of itself a product of discontent with traditional education . . . In effect it is a criticism of the latter” (Dewey, 1938, p. 129). Policy makers must be cautious when mixing education with *Olympic* and *World Cup* style competitions (Kohn, 2010). Education is not a sport; and if educational officials want our students to do well, they should consider removing the one-size-fits-all standards mandates and replace them with more holistic targets. This in turn will allow students to perform at their

developmental levels, creating a well-balanced, creatively inclined student who is inspired by the innovation of creating a robot, not designed and trained to act like one. Wang, Haertel, and Walberg (1993) found that education that directly influences a student will have a direct and positive effect on student learning as compared to indirect influences such as national standards. “Advocates of national standards tell us they want all students to attain excellence, no matter where they happen to live” (Kohn, 2010). Even Dewey (1938) nearly 75 years ago argued that external influences will increase, not decrease, the education and social gap policy makers so desperately want to close (p. 129). If we are going to push for national reform that gives students the opportunity to attain realistic goals, then we should consider replacing nationally influenced standards with more holistic targets. “When external control is rejected, the problem becomes that of finding the factors of control that are inherent with experience” (Dewey, 1938, p. 160). “High standards don’t require common standards. Uniformity is not the same thing as excellence—or equity. (In fact, one-size-fits-all demands may offer the illusion of fairness, setting back the cause of genuine equity)” (Kohn, 2010, par. 10). It would be unfair to force all students in a ninth grade physical education class to master the sport of archery at the same time and score Proficient or Advanced Proficient on the same final assessment. Some students are more skilled than others at the sport, and that is all right; that is what a democratic and holistic education should be. A holistic educational curriculum is echoed in Aiken’s (1942) Eight-Year Study where college prescriptions were removed to give students the opportunity to focus more on their personal growth within their community. The results of this study prove that the new standards, known as the Common Core State Standards, are no more engaging than older standards. As a matter of empirical fact, this study and others demonstrated that the opportunity for students to reach higher order thinking skills could potentially decrease based on the low

cognitive complexity of the CCSS. Unfortunately, no such evidence exists of countries providing both a successful nationalized curriculum and a holistic and creative education (Kohn, 2010). A one-size-fits-all system of education “which professes to be based on the ideas of freedom may become as dogmatic as ever was the traditional education which it reacted against” (Dewey, 1938, p. 181). An intended curriculum that is created far from the local realities of the student, such as the CCSS, can have less of an impact than one that is created closer to home (Tienken, 2011). Policy makers can use a nearly one hundred year old set of principles as a guide to creating a holistic curriculum free from standardization. *The Cardinal Principles of Secondary Education* (1918) have holistic learning embedded into their principles and provide students with the tools necessary to “practice nonconventional models of thinking that enhance motivation” (Burke-Adams, 2007, p. 59). The “administrative progressives” need to stop the illusion of Tyack’s “one best system” of education and embrace a holistic education that supports the complex democratic and creative 21st century system of education (Howe & Meens, 2012).

Implications/Recommendations for Practice

1. School level administrators must promote and offer more real-world, innovative, creative, and practical experience electives at the high school level that would enable students to build analytical and problem-solving skills not offered through CCSS but needed to succeed in a 21st century college and career workforce.

Currently adopted by 45 states and the District of Columbia, the NGA and CCSSO contend that the CCSS will emphasize the critical thinking, problem-solving, and creativity skills business leaders are looking for in our students. Certainly, the results of this study prove otherwise and would not fit into Dewey’s theory of education, which emphasizes critical and creative thinking. What is particularly concerning is that current reform movements mirror a

failed movement by the Committee of Ten (1893), which advocated revising high school curricula solely for the purpose of students satisfying college course prescriptions. Today, we are potentially repeating an unsuccessful and nearly one hundred year old philosophy of education by narrowing our curriculum to a prescribed set of courses needed to succeed on state tests, and eliminating electives that allow students to think, grow, and use innovative problem-solving skills (Tienken & Orlich, 2013, p. 6). This is also in contrast to the skills business leaders are asking for students to have. Business leaders ask for employees that can demonstrate the ability to think creatively and analytically and demonstrate the abilities to problem solve, strategize, adapt, and innovate (American Society for Training and Development, 2009; Adobe, 2012; IBM Study, 2010; Kyllonen, 2012). The New Jersey Department of Education officially pledged to adopt the CCSS in 2009 and concluded final adoption of the CCSS in 2010, approximately two months after the CCSS were submitted to the states in final form. School districts in New Jersey were mandated to replace their old Math and ELA intended and enacted NJCCCS curricula with the intended CCSS and to create enacted curricula aligned to it. The results of this study paint a picture of a potential lack of complex skills being attained in math and English Language Arts by New Jersey high school students. Due to the large investment already made into the CCSS, a full withdrawal, however enticing, might not be practical. I would recommend that high school administrators recognize the creativity gap within the CCSS and promote and offer more real-world, innovative, creative, and practical experiences within their math and ELA classes as well as the few free electives that students still are allowed to take at the high school level.

Real world career-oriented electives would enable students to build the entrepreneurial, analytical, and problem-solving skills they might not be building with the CCSS, although these are necessary to succeed in a 21st century college and career workforce. The U.S. Department of

Education says that “entrepreneurship education as a building block for a well-rounded education not only promises to make school rigorous, relevant, and engaging, but it creates the possibility for unleashing and cultivating creative energies and talents among students” (as cited in Zhao, 2012). The McKinsey Global Institute study, which surveyed over 2,000 business leaders, found that job applicants were severely lacking 21st century skills such as problem solving and communication. (Manyika, Lund, Auguste, Mendonca, Welsh, & Ramaswamy, 2011). Career exploration programs, such as an 11th and 12th grade internship program and Grades 9-12 career-oriented specialized electives could prove to be an effective supplement in exposing students to the realistic demands of today’s workforce, while assisting them in developing critical 21st century problem solving and communication skills that might not be addressed in their current ELA and Math classrooms under the CCSS. The *Competitiveness and Innovative Capacity* report states that “given the pace of change in today’s global economy, investments to promote innovation deserve more emphasis than at any time in the past” (U.S. Department of Commerce, 2012, pp. 2-3). College and career-driven elective courses will also provide students with Dewey’s “motivational forces of the creative individual” (Hiillmiin, 1964, p. 282). Hiillmiin (1964) stresses how these “forces” can connect students with their surroundings, creating awareness and drawing on prior experiences as opposed to courses solely focused on CCSS and test preparation which could hinder their creative awareness. Dewey professes a connection between motivational forces and creativity, stating that students who are enrolled in courses that focus more on their personal careers and interests start to experience “feelings of immediate enjoyment,” beginning to see the connection to other courses and increasing academic achievement (Hiillmiin, 1964, p. 282).

2. School level administrators must help teachers to create a school of divergent thinkers beyond lecture and recitation skills.

Top-down accountability mandates have decreased teacher autonomy and have narrowed the curriculum to a few low cognitive standards that could potentially prevent students from gaining valuable 21st century skills (Giroux & Schmidt, 2004, p. 214). “The U.S. climate of high-stakes testing and scripted curriculums makes it difficult for education stakeholders to infuse creativity into teaching practices” (Henriksen & Mishra, 2013; Giroux & Schmidt, 2004). The results of this study exacerbate the recent pressure placed on teachers to “teach to the test” or risk losing points on their evaluation. If the results of this study had proved that the CCSS were high in cognitive complexity with the potential to have students build higher-order thinking skills, there would be no need for me to make the following recommendation. This study proved that the CCSS will not provide students with the necessary skills needed to succeed in a 21st century workforce, yet the mandate will further force teachers to “abandon their sense of creativity and autonomy in the classroom, ignore the specificities of children’s lives and problems and, in general, be less attentive to the vast differences that students often bring with them” (Giroux & Schmidt, 2004, p. 221). Recognizing the results of this study, school administrators should provide professional development to train staff on how to use Webb’s Depth of Knowledge levels to integrate creativity, analytical and critical thinking, and problem-solving skills into their enacted curriculum, lessons, and assessments, as a supplement to the lack of these skills embedded in their Grades 9-12 ELA and Math intended curriculum. The results of this study proved that there is not much flexibility within the CCSS. In order for teachers to create a school of divergent thinkers, standards must be flexible so that students do not reach what Tindell (1997) calls a “mental block” or what Runco & Chand (1995) call “functional fixedness” (as

cited in Ward, Smith, & Finke, 2010, p. 201). According to the results of this study, the ELA and Math CCSS will not enable students to see the creative alternative solutions to a problem due to the “rigidity or mental state which locks thinking.” (Runco & Chand, 1995, p. 247). I would recommend that local school administrators assist teachers in creating a school of divergent thinkers that break free from this cognitive block so that students can form cognitively complex and creative ideas. Administrators should provide training for teachers to use Webb’s DOK framework as a practical tool to develop unique teaching and questioning strategies that will enable students to develop skills “to recognize and overcome involuntary blocks to problem solving and creative thinking” that, based on the results of this study, they will potentially encounter with the CCSS (Ward et al., 2010, p. 202). The CCSS, based on the results of this study, emphasize simple knowledge that Runco and Chand (2005) label as declarative and procedural knowledge. As explained in Chapter I, the cognitive potential of declarative and procedural knowledge is necessary, but limited. Declarative and procedural knowledge provide only the foundation needed to reach complex and extended forms of thinking. This study proved that deeper levels of cognitive demand are absent from the CCSS, making them more repetitive in nature than complex; efforts to help our students be creative and original can be jeopardized if teachers are forced to rely solely on convergent standards (Runco & Chand, 1995, p. 245). A high percentage of the CCSS in ELA and math stop at declarative and procedural knowledge, convergent areas that do not contain the divergent complexity of a Webb DOK Level 3 and 4, which is emphasized in the exploration and interpretation component of Finke’s (1995) geneplore model. Runco and Chand (2005) and Finke (1995) proved that standards are an essential part of the creative process, but only if they reach the exploration and interpretation phase; that is, a Webb DOK Level 3 and 4.

Henriksen and Mishra (2013) found that over 90% of National Teacher of the Year recipients emphasized the importance of creativity in their teaching methods. School administrators must use their own creative organizational techniques in order to help their teachers be creative so they can create a school of divergent thinkers. Burns (1972) spoke of the McGavock curriculum over 40 years ago, a curriculum that allows administrators flexibility in having teachers teach subjects according to their abilities and interests (p. 533). This model is recommended by Henriksen and Mishra (2013) today. Many of the teachers that were awarded National Teacher of the Year awards use unique forms of divergent practices that connect to “their interests and creative ways of thinking,” which are then infused into their lessons (par. 9). A second suggestion, which is echoed throughout this study, is to link all lessons to real-world applications. Creativity cannot be standardized; it cannot “occur in a vacuum” (Runco & Chand, 1995, p. 252). However, since the CCSS is a form of standardization and the results of this study prove that they are low in creativity, school administrators must train teachers on how to “take knowledge out of a vacuum and infuse it into an authentic experience” which will “ensure that creativity is grounded in relevant learning” (Henriksen & Mishra, 2013, par.17). A third approach to help teachers create a school of divergent thinkers is to “cultivate a creative mind-set” (Henriksen & Mishra, 2013, par. 25). This is in line with Dewey’s (1938) approach of making students aware of their surroundings and incorporating this into teaching practices. In order to prepare students to be analytical and innovative thinkers, students need to analyze previous knowledge with current knowledge and link it to their local environment. A teacher that promotes creativity will find him/herself becoming a facilitator of knowledge, encouraging students to take a direct role in the learning process and connecting more with their surroundings (Henriksen & Mishra, 2013). A fifth recommendation to help teachers create a school of

divergent thinkers apart from the convergent CCSS is to “value collaboration” (Henriksen & Mishra, 2013). Henriksen and Mishra (2013) argue that although creative work can certainly happen by working alone, collaborating with peers can illuminate new ideas and serve as “an excellent creative catalyst” (par. 31). A recommendation to administrators would be to design high school courses with adequate time for collaboration, creativity, and innovative work.

Last, administrators must allow teachers the opportunity to “take intellectual risks” (Henriksen & Mishra, 2013, par. 32). Creativity is both original and appropriate and teachers that take risks, make mistakes, and learn from those mistakes teach their students a valuable lesson in how to be a divergent, innovative, and creative thinker. With the avalanche of accountability mandates pressured on today’s teachers, they are often fearful of trying new and creative approaches to teaching. Administrators should consider eliminating the pressure of having staff teach to the test and chase standardized test scores and support teachers that want to try new creative approaches. These approaches are what will motivate and excite teachers to help students to reach extended forms of thinking that, according to the results of this study, can be absent from today’s high school students.

3. School level administrators must infuse creativity and critical thinking into all parts of the curriculum through inquiry and problem-based learning.

Success in school today seems to be mainly measured by one’s success on a standardized assessment, which will be aligned to the CCSS, rather than on important 21st century skills such as critical thinking and problem solving (Giroux & Schmidt, 2004. p. 222). Aiken’s (1942) landmark Eight-Year Study emphasized five critical principles essential in the development of creative and critical thinking: (1) strong emphasis on the student, (2) personal experiences, (3) different developmental styles, (4) problem solving and making prior knowledge connections,

and (5) the ability to approach problems through many different lenses. The literature shows that creativity is a critical component of entrepreneurship, problem finding, and problem solving (Burke-Adams, 2007, p. 59). There should be a conscious effort among high school administrators to increase creativity within their school curriculum, especially since this study proves its deficit within the adopted standards, the CCSS. I recommend that school administrators embrace and embed creativity into the school curriculum so that every student has the opportunity to make “the most important decision in his or her life: the decision to be creative” (Stenberg, 2003, p. 337). School leaders must encourage creativity and involvement in the arts, music, and career and technology education programs and not cut such programs every time there is a budget crisis or because more state test prep courses need to be implemented. The Assessing and Teaching of 21st Century Skills study (Cisco et al., 2010) states that creativity, critical thinking, problem-solving, decision-making, and learning are amongst the most important skills needed to succeed in a 21st century economy. An inquiry and problem-based learning curriculum can be the answer to helping students build creativity and critical thinking skills that are absent from the current intended curriculum. Inquiry and problem-based learning will promote Aiken’s (1942) “strong emphasis on the student” and assist students in comprehending the language, reasoning, and understanding of ideas and their complex connection to current and past acquired knowledge. Inquiry and problem-based learning is student-centered, helping students to create and innovate, thus supplementing the lack of creativity and innovation they will receive from the CCSS.

The ideas of creativity within inquiry and problem-based learning in education date back to the works of John Dewey (1916) and the *Cardinal Principles of Secondary Education* (1918). The *Cardinal Principles of Secondary Education* (1918), often thought of as “education’s

Declaration of Independence,” advocated for a more hands-on, democratic, experiential and problem-finding curriculum (Tienken & Orlich, 2013, p. 9). The principles afforded the opportunity for students to be creative and think critically.

Dewey (1916) was an advocate of inquiry and problem-based learning. Like Dewey, today’s administrators must stress the importance that all students must be part of this progressive and essential reform effort. “When teachers and schools skip the problem-formulating stage—handing facts and procedures to students without giving them a chance to develop their own questions and investigate by themselves—students may memorize material but will not fully understand or be able to use it” (Delisle, 1997, p. 1). The literature on problem solving and creativity points to an important study by Csikszentmihalyi and Getzel (1971) who found that students that used problem-finding skills were more likely to create original and innovative pieces of work, the main components of creativity (as cited in Runco & Chand, 1995, p. 253). An inquiry and problem-based learning curriculum can promote critical thinking, problem solving, creativity, and innovation, essential skills needed to succeed in the 21st century (Trilling & Fadel, 2009, pp. 96-97). Problem-based learning (PBL), which incorporates problem finding and problem solving, is an important 21st century skill that needs to be infused into all parts of a creative school curriculum. Researchers have contended that “creativity involves the ability to integrate, reorganize, or restructure existing knowledge structures” (Bakan & Charlton, 1988, p. 315). Chand (1995) believes that problem finding is a critical part of “creative cognition” (p. 244). An inquiry and problem-based curriculum can help students to reorganize and restructure existing knowledge and “provides a structure for discovery that helps students internalize learning and leads to greater comprehension” (Delisle, 1997, p. 1). Based on the results of this study, the CCSS can result in an enacted and assessed curriculum that is low in

complexity and depth of knowledge. A curriculum low in complexity makes it difficult for students to develop necessary 21st century competencies that lead to creative and original thought (Gardiner, 1972, p. 327). An inquiry and problem-based enacted curriculum could assist high school administrators in supplying students with the necessary skills absent from their intended curriculum. Inquiry and problem-based learning can help students reach extended levels of thinking by requiring them to “make multiple connections between several different key and complex concepts” (Gardiner, 1972, p. 327; Webb, 2005) “Since PBL starts with a problem to be solved, students working in a PBL environment must become skilled in problem solving, creative thinking, and critical thinking” (Roh, 2003). Inquiry and problem-based learning are innovative approaches in helping students build 21st century skills while still “mastering important subject knowledge” (Delisle, 1997, p.6).

The literature points to evidence that innovative thinking cannot begin when students are focused on solving ill-structured problems. With the low distribution and percentage of cognitive complexity in the Grades 9-12 Math CCSS, incorporating inquiry and problem-based learning strategies will be necessary in helping students reach more complex levels of thinking. Administrators must promote and advocate for inquiry and problem-based learning over the static and convergent methods embedded into the CCSS. “In contrast to conventional classroom environments, a PBL environment provides students with opportunities to develop their abilities to adapt and change methods to fit new situations” (Roh, 2003, p. 3). It is recommended that administrators support teachers in allowing learning to be more flexible in order for them to help students build “critical thinking and reasoning skills,” as well as problem-finding and problem-solving skills that are far more important today than rote memorization and recitation (Delisle, 1997, p. 5). Dewey (1916) contends that the only way to move a society forward is to promote a

democratic school system that advocates for a student-centered school system that allows the individual to create and solve problems.

Conclusion

The intent of this study was to determine if deeper levels of critical and creative thinking were manifested within the Grades 9-12 CCSS and NJCCCS; and if so, how much. The study proves that, overall, New Jersey's previous Grades 9-12 ELA and Math standards enabled curriculum writers and teachers to create curricula that allowed students to reach deeper forms of creative thinking. Although this could be potentially negative news for the state of New Jersey and other states that were quick to adopt the CCSS, it also starts a responsible discussion on ensuring that high school students in New Jersey and around the nation do not fall any further behind in the global innovation and creativity race. In order to truly prepare New Jersey high school students for college and careers in the 21st century, policy makers, school administrators, teachers, and parents must collaborate in creating and adopting an intended curriculum that mimics these core values. Stakeholders invested in New Jersey public school education must ask themselves if adopting the CCSS, without assessing its 21st century creative potential, was the best decision for New Jersey high school students. Realizing the significance an intended curriculum (content standards) and the cognitive complexity distribution that curriculum can have on teaching and learning, it is imperative that local, state, and national education leaders come together and develop a plan of action on how to remedy the results of CCSS as demonstrated in this study.

"The consequence seems to be that the philosophies of education which have been most influential in the formation of American school policies and practices have been logically unable to accommodate the concept of creativity" (Hiillmiin, 1964, p. 270).

Our creative edge in the global market has been exponentially decreasing, and creating and implementing curricula into our public high schools that thwarts the need for creative change can further ill prepare students for the real demands of our 21st century society while decreasing our collective economic competitiveness. “If creative activity is to be taken seriously and if it is to be accorded its rightful place in education and in life, then philosophical systems must make some adjustments in order to account for its most distinctive feature, the progressive emergence of novelty” (Hillmiin, 1964, p. 271). Creativity must be at the core of all good teaching and good schools. An intended curriculum must be a dynamic set of pre-inventive structures that continuously adapts to the local, state, national, and global creative demands of a 21st century society. This study can be eloquently summed up by a statement made by Piaget who stated that “the principal goal of education is to create [people] who are capable of doing new things, not simply repeating what other generations have done—[people] who are creators, inventors, and discoverers” (qtd. in Duckworth, 1964, p. 175).

References

- ACT. (2010). A first look at the Common Core and college and career readiness. Retrieved from <http://www.act.org/research/policymakers/pdf/FirstLook.pdf>
- Adobe. (2012). State of create study: StrategyOne. Retrieved from http://www.adobe.com/aboutadobe/pressroom/pdfs/Adobe_State_of_Create_Infographic.pdf
- Aikin, W. M. (1942). *The story of the Eight-Year Study: With conclusions and recommendations*. New York, NY: Harper & Bros.
- Airasian, P. W., & Miranda, H. (2002). The role of assessment in the revised taxonomy. *Theory into practice*, 41(4), 249-254.
- Albert, R. S., & Runco, M. A. (2009). A history of research on creativity. In R. J. Sternberg (Ed.), *Handbook of Creativity* (pp. 16-31). New York, NY: Cambridge University Press.
- Amabile, T. (2013). Componential theory of creativity. In E. Kessler (Ed.), *Encyclopedia of management theory*. (pp. 135-140). Thousand Oaks, CA: SAGE. doi: 10.4135/9781452276090.n42
- American Society for Training and Development (ASTD). (2009). *Bridging the skills gap*. Retrieved from <http://www.astd.org/%20About/~//media/Files/About%20ASTD/Public%20Policy/%20BridgingtheSkillsGap2010.pdf>
- Anderson, L.W., & Krathwohl, D. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives*. New York, NY: Longman.
- Baines, L. (2011). Stalinizing American education. *Teachers College Record Online*. Retrieved from <http://www.tcrecord.org> ID Number 16545

- Baurlein, M., & Stotsky, S. (2012). How Common Core's ELA standards place college readiness at risk. (Pioneer Institute White Paper #89). Boston, MA: Pioneer Institute.
- Becker, M. (1995). Nineteenth-century foundations of creativity research. *Creativity Research Journal*, 8(3), 219-229.
- Belanger, E. (2014, February). New York public schools delay common core standards after test scores nosedive. Retrieved from www.AL.com:www.al.com/wire/2014/02/new_york_schools_delay_common.html
- Bhattacharya, M. (2002). Creating a meaningful learning environment using ICT. *Electronic Portfolios (SITE 2002 Section)*, 536-538. Retrieved from <http://www.cdtl.nus.edu.sg/brief/v5n3/sec3.htm>
- Blank, R. K., Porter, A., & Smithson, S. (2001). *New tools for analyzing teaching, curriculum and standards in mathematics and science*. Report from Survey of Enacted Curriculum Project (National Science Foundation REC98-03080). Washington, DC: Council of Chief State School Officers.
- Bloom, B. S. (1956). *Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain*. New York, NY: Longmans, Green.
- Boden, M. A. (1999). Computer models of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 351-372). New York, NY: Cambridge University.
- Bolman, L. G., & Deal, T. E. (2008). *Reframing organizations: Artistry, choice and leadership* (4th ed.). San Francisco, CA: Jossey-Bass.
- Bronson, P., & Merryman, A. (2010). The creativity crisis: For the first time, research shows that American creativity is declining. What went wrong—and how can we fix it? Retrieved from <http://www.newsweek.com/creativity-crisis-74665>

- Burke-Adams, A. (2007). The benefits of equalizing standards and creativity: Discovering a balance in instruction. *Gifted Child Today*, 30(1).
- Burke, L. (2012). States must reject national education standards while there is still time. (Backgrounder #2680 on Education). Retrieved from <http://www.heritage.org/research/reports/2012/04/states-must-reject-national-education-standards-while-there-is-still-time>
- Byrd, P. A. (2002). The revised taxonomy and prospective teachers. *Theory into Practice*, 41(4), 244-248.
- Cachia, R., Ferrari, A., Ala-Mutka, K., & Punie, Y. (2010). *Creative learning and innovative teaching: Final report on the Study on Creativity and Innovation in Education in EU Member States* (No. JRC62370). Seville, Spain: Institute for Prospective and Technological Studies, Joint Research Centre.
- Charlton, S., & Bakan, P. (1988). Cognitive complexity and creativity. *Imagination, Cognition and Personality*, 8(4), 315-322.
- Chi, Y., Garcia, R. B., Surber, C., & Trautman, L. (2011). Alignment study between the Common Core State Standards in English Language Arts and Mathematics and the WIDA English Language Proficiency Standards: Pre-kindergarten through Grade 12 (2007 ed.). Norman, OK: University of Oklahoma College of Continuing Education. ETEAM.
- Cisco Systems Inc., Intel Corporation, Microsoft Corporation, & University of Melbourne. (2010). Assessment and teaching of 21st century skills (ATC21S). Retrieved from <http://www.cisco.com/web/strategy/docs/education/atc21s.pdf>
- Clark, C. W. (2008). *Estimates of association between cognitive complexity levels and*

- creativity levels of field grade military officers: An exploratory study of the relationship.* (Doctoral Dissertation). Retrieved from <http://krex.k-state.edu/dspace/bitstream/handle/2097/858/ChadwickClark2008.pdf?sequence=1>
- Copeland, A. (1980). *Music and imagination*. Cambridge, MA: Harvard University Press.
- Craft, A. (2005). *Creativity in schools: Tensions and dilemmas*. New York, NY: Routledge.
- Csikszentmihalyi, M. (1997). *Creativity: Flow and the psychology of discovery and invention*. New York, NY: Harper Perennial.
- Delisle, R. (1997). *How to use problem-based learning in the classroom*. Alexandria, VA: ASCD.
- Dewey, J. (1958). *Experience and nature* (Vol. 1). New York, NY: Courier Dover Publications.
- Dorn, S. (2013). Bottom 10 Common Core blarney. Retrieved from <http://nepc.colorado.edu/blog/bottom-10-common-core-blarney>
- Duckworth, E. (1964). Piaget rediscovered. *Journal of Research in Science Teaching*, 11(7), 496-499. Retrieved from <http://www.jstor.org/discover/10.2307/41186862?uid=3739808&uid=2129&uid=2134&uid=2&uid=70&uid=4&uid=3739256&sid=21104801456697>
- Education Research Center. (2011, June 11). National graduation rate rebounds; 1.2 million students still fail to earn diplomas [Press Release]. Retrieved from http://www.edweek.org/media/diplomascount2011_pressrelease.pdf
- Ennis, R. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership*, 43(2), 44-48.
- Evans, C. (1999). Improving test practices to require and evaluate higher levels of thinking. *Education*, 119, 616-618.

- Evers, W. (2001). Standards and accountability. In T. M. Moe (Ed.), *A primer on America's schools* (pp. 205-237). Stanford, CA: Hoover Institution Press.
- Feist, G. J., & Runco, M. A. (1993). Trends in the creativity literature: An analysis of research in the *Journal of Creative Behavior* (1967–1989). *Creativity Research Journal*, 6(3), 271-283.
- Finegold, D., & Notabartolo, A. S. (2008). *21st century competencies and their impact: An interdisciplinary literature review*. Retrieved from the William and Flora Hewlett Foundation website:http://www.hewlett.org/uploads/21st_Century_Competencies_Impact.pdf
- Finn, C. (2012) The conservative case for the Common Core. Retrieved from <http://educationnext.org/the-conservative-case-for-the-common-core/>
- Gamoran, A., Porter, A. C., Smithson, J., & White, P. A. (1997). Upgrading high school mathematics instruction: Improving learning opportunities for low-achieving, low-income youth. *Educational Evaluation and Policy Analysis*, 19(4), 325-338.
- Gardiner, G. S. (1972). Complexity training and prejudice reduction. *Journal of Applied Social Psychology*, 2, 326–342. doi: 10.1111/j.1559-1816.1972.tb01284.x
- Gardner, H. (2000). *The disciplined mind: Beyond facts and standardized tests, the K-12 education that every child deserves*. New York, NY: Penguin Books.
- Giordano, M. (2012). Ravitch says new evaluation system is 'madness.' Retrieved from <http://www.wnyc.org/blogs/schoolbook/2012/feb/22/ravitch-new-evaluation-system-is-madness/>
- Giroux, H. A., & Schmidt, M. (2004). Closing the achievement gap: A metaphor for children left

- behind. *Journal of Educational Change*, 5, 213–228. Retrieved from <http://www.sfu.ca/~dlaitsch/courses/962/2006/giroux.pdf>
- Glaveanu, V. P. (2013). Rewriting the language of creativity: The five A's framework. *Review of General Psychology*, 14(1), 69-81.
- Gorny, E. (2007). Study of genius. Retrieved from http://creativity.netslova.ru/Study_of_genius.html
- Guisbond, L., Neill, M., & Schaeffer, B. (2012). NCLB's lost decade for educational progress: What can we learn from this policy failure? Retrieved from http://www.fairtest.org/sites/default/files/nclb_lost_decade_executive_summary.pdf
- Henriksen, D., & Mishra, P. (2013). Learning from creative teachers. *Educational Leadership*, 70(5). Retrieved from <http://www.ascd.org/publications/educational-leadership/feb13/vol70/num05/Learning-from-Creative-Teachers.aspx>
- Hess, K., Carlock, D., Jones, B., & Walkup, J. R. (2009). What exactly do “fewer, clearer, and higher standards” really look like in the classroom? Using a cognitive rigor matrix to analyze curriculum, plan lessons, and implement assessments. Retrieved from: http://www.nciea.org/publications/cognitiverigorpaper_KH12.pdf
- Hillmiin, R. J. (1964). The concept of creativity in Dewey's educational philosophy. *Educational Theory*, 14(4), 270-285.
- Holland, N. N. (2009). *Literature and the brain*. Gainesville, FL: The PsyArt Foundation.
- Howe, K. R., & Meens, D. (2012). Democracy left behind: How recent education reforms undermine local school governance and democratic education. Boulder, CO: National Policy Education Center. Retrieved from <http://nepc.colorado.edu/publication/democracy-left-behind>

- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277-1288.
- IBM Study. (2010). Global chief executive officer study. Retrieved from <http://www-935.ibm.com/services/us/en/c-suite/ceostudy2012/>
- Jirka, S. J., & Hableton, R. K. (2005). Cognitive complexity levels for MCAS assessments. Retrieved from <http://www.umass.edu/remp/docs/MCAS-RR-10.pdf>
- Jonassen, D. H., Peck, K., & Wilson, B. G. (1999). Learning with technology: A constructivist approach. Upper Saddle River, NJ: Merrill.
- Kim, K. H. (2006). Can we trust creativity tests? A review of the Torrance Tests of Creative Thinking (TTCT). *Creativity Research Journal*, 18(1), 3-14.
- Kohn, A. (2010). Debunking the case for national standards. *Education Week*, 29(17), 28-30.
- Koret Task Force on K-12 Education. (2012, February). *Choice and federalism: Defining the federal role in education*. Retrieved from www.choiceandfederalsim.org.
- Kyllonen, P. C. (2012, May). *Measurement of 21st century skills within the Common Core State Standards*. Paper presented at the K-12 Center at ETS Invitational Research Symposium on Technology Enhanced Assessments. Retrieved from <http://www.k12center.org/rsc/pdf/session5-kyllonen-paper-tea2012.pdf>
- Langely, P., & Jones, R. (1988). A computational model of scientific insight. In R. Sternberg (Ed.), *The nature of creativity: Contemporary psychological perspectives*. New York, NY: Cambridge University Press.
- Lopez, G., Newmann, F., Gudelia, L., & Byrk, A. S. (1998). *The quality of intellectual work in Chicago schools: A baseline report*. Chicago, IL: Consortium on Chicago School Research.

- Manyika, J., Lund, S., Auguste, B., Mendonca, L., Welsh, T., & Ramaswamy, S. (2011). *An economy that works*. Washington, DC: McKinsey Global Institute.
- Markham, T. (2012). PBL & Common-Core-Standards. Retrieved from:
<http://www.thommarkham.com/blog/default/pbl-and-common-core-standards/>
- Marshall, K. (2005). It's time to rethink teacher supervision and evaluation. Retrieved from
<http://myboe.org/cognoti/content/file/resources/documents/80/807dc8a9/807dc8a925188551db0ce0a6eb1c05f5f322fcf7/TeachersupervisionarticleKimMarshall.pdf>
- Martini, P. H. (2008). *Toward an integrated model of visionary leadership: A multilevel study* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (Accession Order No. 3325634)
- Martone, A., & Sireci, S. G. (2009). Evaluating alignment between curriculum, assessment, and instruction. *Review of Educational Research*, 19(9), 11–16.
- Mayring, P. (2000). Qualitative content analysis. *Forum: Qualitative Social Research*, 1(2).
 Retrieved from <http://www.qualitative-research.net/index.php/fqs/article/view/1089/2386>
- McGuinn, P. J. (2006). *No Child Left Behind and the transformation of federal education policy, 1965-2005*. Lawrence, KS: University Press of Kansas.
- Meier, D. (2000). *Will standards save public education?* Boston, MA: Beacon Press.
- Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook*. Thousand Oaks, CA: Sage.

Mooney, J. (2013). Two tenure law sponsors now seek delay in tougher teacher evaluations.

Retrieved from <http://www.njspotlight.com/stories/13/06/06/tenure-law-sponsors-now-seek-delay-in-tougher-teacher-evaluations/>

Moore, T. O. (2013). *The story-killers: A common-sense case against the common core*.

Createspace Independent Publisher.

Morrison, B. (2010, November 1). Focus on issues and decision making: Why creativity

matters. Retrieved from <http://www.nammfoundation.org/articles/2014-04-10-focus-issues-decisionmaking-why-creativity-matters>

National Assessment Governing Board. (2013a). *Mathematics framework for the*

National Assessment of Educational Progress. Washington, DC: Author. Retrieved from <http://www.nagb.org/content/nagb/assets/documents/publications/frameworks/math-2013-framework.pdf>

National Assessment Governing Board. (2013b). *Reading framework for the 2005 National*

Assessment of Educational Progress. Washington, DC: Author. Retrieved from <http://www.nagb.org/content/nagb/assets/documents/publications/frameworks/reading-2013-framework.pdf>

National Assessment of Educational Progress. (2011a). The nation's report card: Math 2011.

Retrieved from <http://nces.ed.gov/nationsreportcard/pubs/main2011/2012457.asp>

National Assessment of Educational Progress. (2011b). The nation's report card: Reading 2011.

Retrieved from <http://nces.ed.gov/nationsreportcard/pubs/main2011/2012457.asp>

National Education Association. (2012). *Preparing 21st century students for a global society: An*

educator's guide to "the four Cs." Washington, DC: Author. Retrieved from <http://www.nea.org/assets/docs/A-Guide-to-Four-Cs.pdf>

- National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010a). *Common Core State Standards*. Washington, DC: Author.
- National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010b). *Common Core State Standards for English language arts and literacy in history/social studies, science, and technical subjects*. Washington, DC: Author.
- National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010c). *Common Core State Standards for Mathematics*. Washington, DC: Author.
- New Jersey Department of Education. (2013). Educator evaluation and support in New Jersey. Retrieved from <http://www.state.nj.us/education/AchieveNJ/intro/1PagerTeacher.pdf>
- New Jersey School Boards Association. (2011). Good news: New Jersey public schools. Retrieved from <http://www.njsba.org/PI/goodnews/>
- Nickerson, R. S. (1999). Enhancing Creativity. In R. J. Sternberg (Ed.), *Handbook of Creativity* (pp. 392-430). Cambridge, MA: Cambridge University Press.
- Niebling, B. C. (2012a). Determining the cognitive complexity of the Iowa Core in Literacy and Mathematics: Implications and applications for curriculum alignment. Des Moines, IA: Iowa Department of Education. Retrieved from http://www.educateiowa.gov/index.php?option=com_docman&task=doc_download&gid=14524&Itemid=5111.
- Niebling, B. C. (2012b). Using Webb's alignment model to measure intended-enacted curriculum alignment: A brief treatment. Des Moines, IA: Iowa Department of Education.
- OECD. (2011). PISA 2009 Results: What Students Know and Can Do: Student

- Performance in Reading, Mathematics and Science. Retrieved from <http://www.oecd.org/pisa/pisaproducts/48852548.pdf>
- OECD. (2014). PISA 2012 Results: Results in Focus: What 15-year-olds know and what they can do with what they know. Retrieved from <http://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf>
- Padget, S. (2013). *Creativity and critical thinking*. Milton Park, NY: Routledge.
- PARCC. (2010). Partnership for assessment of readiness for college & careers. Retrieved from <http://www.parcconline.org/>
- Park, G., Lubinski, D., & Benbow, C. P. (2007). Contrasting intellectual patterns predict creativity in the arts and in the sciences: Tracking intellectually precocious youth over 25 years. *Psychological Science*, 18, 948-952.
- Parks, G. N. (2010). Why creativity matters. Retrieved from <http://artsedresearch.typepad.com/blog/2010/11/why-creativity-matters.html>
- Pickard, M. J. (2007). The new Bloom's taxonomy: An overview for family and consumer sciences. *Journal of Family and Consumer Sciences Education*, 25(1), 45-55.
- Pink, D. (2009, October 19). *Keynote address at the Inspiring Education Fall Forum*. Public School Board Association of Alberta [PSBAA School Act Review Blog]. Retrieved from <http://psbaaschoolactreview.wordpress.com/2009/10/19/daniel-pinks-address-at-the-inspiring-education-fall-forum/>
- Porter, A. C. (2002). Measuring the content of instruction: Uses in research and practice. *Educational Researcher*, 31(7), 3-14.

- Porter, A., McMaken, J., Hwang, J., & Yang, R. (2011). Common Core Standards: The new U.S. intended curriculum. *Educational Researcher*, 40(3), 103–116. doi: 10.3102/0013189X11405038
- Ravitch, D. (2012). No student left untested. *The New York Review of Books*. Retrieved from <http://www.nybooks.com/blogs/nyrblog/2012/feb/21/no-student-left-untested/>
- Robinson, K. (2001). Out of our minds: Learning to be creative. Oxford, England: Capstone.
- Roh, K. H. (2003). Problem-based learning in mathematics. ERIC Clearing house for Science Mathematics, and Environmental Education [ED482725]. Retrieved from <http://www.ericdigests.org/2004-3/math.html>
- Rolnick, A. J., & Grunewald, R. (2007). Achieving a high return on early childhood investment: Evidence, proposal, and the Minnesota pilot. Retrieved from http://www.oregoncf.org/Templates/media/files/grants/Early%20Childhood/HighReturnEarlyChildhood_Final200711.pdf
- Runco, M. A. (2007). Creativity: Theories and themes: Research, development and practice. San Diego, CA: Elsevier Academic Press.
- Runco, M. A. (2012). The standard definition of creativity. *The Creativity Research Journal*, 24(1), 92-96.
- Runco, M. A., & Chand, I. (1995). Cognition and creativity. *Educational Psychology Review*, 7(3), 243-267.
- Sandholtz, J. R. (2004). Standards & gaps: Unintended consequences of local standards-based reform. *Teachers College Record*, 106(6), 1177-1202.
- Sato, E., Lagunoff, R., & Worth, P. (2011). SMARTER Balanced Assessment Consortium

- Common Core State Standards analysis: Eligible content for the summative assessment. (Final Report). Retrieved from eric.gov?id=ED536959
- Schneider, M. (2013, November 3). Common Core unrest obvious in 17 states. Retrieved from <http://deutsch29.wordpress.com/2013/11/23/common-core-unrest-obvious-in-17-states/>
- Shearer, L. (2003). Former UGA professor Paul Torrance dies. *Athens Banner-Herald*. Retrieved from http://onlineathens.com/stories/071503/uga_20030715023.shtml
- Smith, S. M., & Tindell, D. R. (1997). Memory blocks in word fragment completion caused by involuntary retrieval of orthographically similar primes. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 23, 355-370.
- Standards. (2011, June 28). Education Week. Retrieved from <http://www.edweek.org/ew/issues/standards/>
- Sternberg, R. (1999). *The handbook of creativity*. Cambridge, MA: Cambridge University Press.
- Sternberg, R. (2003). Creative thinking in the classroom. *Scandinavian Journal of Educational Research*, 47, 325-338.
- Stiglitz, J. E. (2012, January). The book of jobs. *Vanity Fair*. Retrieved from <http://www.vanityfair.com/politics/2012/01/stiglitz-depression-201201#>
- Tanner, D., & Tanner, L. (2007) *Curriculum development: Theory into Practice*. Upper Saddle River, NJ: Pearson Education.
- Tienken, C. H. (2010). Social inequity and high school test scores: More strong correlations. *AASA Journal of Scholarship and Practice*, 7(3), 3-5.
- Tienken, C. H. (2010). Strong correlations. *AASA Journal of Scholarship and Practice*, 7(2), 3-4.
- Tienken, C. H. (2011). Common core state standards: An example of data-less decision making. *AASA Journal of Scholarship and Practice*, 7(4), 3-18.

- Tienken, C. H., & Orlich, D. C. (2013). *The school reform landscape: Fraud, myth and lies*. Lanham, MD: Rowman & Littlefield Education.
- Torrence, P. E. (1988). The nature of creativity as manifest in testing. In R. J. Sternberg, *The nature of creativity: Contemporary psychological perspectives* (pp. 43-75). New York, NY: Cambridge University Press.
- Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. San Francisco, CA: John Wiley & Sons.
- Turnipseed, S. (2012). *Partnership for 21st century skills*. Retrieved from <http://www.p21.org/news-events/p21blog/1067>
- U. S. Department of Commerce. (2012). The competitiveness and innovation capacity of the United States. Retrieved from http://www.commerce.gov/sites/default/files/documents/2012/january/competes_010511_0.pdf
- Voelpel, D. (2007). It's time to spark imaginations in the classroom. Retrieved from <http://www.thenewstribune.com/2007/10/31/191989/its-time-to-spark-imaginations.html#storylink=cpy>
- Villalba, E. (2012). Searching for the holy grail of measuring creativity. *Creativity Research Journal*, 24(1), 1-2. Retrieved from <http://www.tandfonline.com/loi/hcrj20>
- Wang, M. C., Haertel, G. D., & Walberg, H. J. (1993). Toward a knowledge base for school learning. *Review of Educational Research*, 63(3), 249-294.
- Ward T. B., Smith, S. M., & Finke, R. A. Creative cognition. In R. J. Sternberg (Ed.), *Handbook of Creativity*. (pp-189-212). New York, NY: CambridgeUniversity Press.

- Webb, N. L. (1997). *Criteria for alignment of expectations and assessments in mathematics and science education* (Research Monograph No. 6). Washington, DC: Council of Chief State School Officers.
- Webb, N. L. (1999). *Alignment of science and mathematics standards and assessments in four states*. Washington, DC: Council of Chief State Officers and National Institute for Science Education.
- Webb, N. L. (2007). Issues related to judging the alignment of curriculum standards and assessments. *Applied Measurement in Education*, 20, 7–25.
- Webb, N. L. (2008a). Alignment analysis of extended reading standards and assessments (Final report). Madison, WI: Department of Public Instruction.
- Webb, N. L. (2008b). Alignment analysis of extended science grade band standards and alternate assessments (Final report). Madison, WI: Department of Public Instruction.
- Webb, N. L. (2008c). Alignment analysis of mathematics extended grade band standards and assessments (Final report). Madison, WI: Department of Public Instruction.
- Webb, N. M., Herman, J. L., & Webb, N. L. (2008). Alignment of mathematics state-level standards and assessments: The role of reviewer agreement. *Educational Measurement: Issues and Practice*, 26, 17–29.
- Weiner, R. (2000). *Creativity and beyond: Cultures, values, and change*. Albany, NY: State University of New York Press.
- Weisberg, R. W. (1999). Creativity and knowledge: A challenge to theories. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 226-250). New York, NY: Cambridge University Press.
- Wyse, A. E., & Viger, S. G. (2011). How item writers understand depth of knowledge.

- Educational Assessment*, 16(4), 185-206. Retrieved from <http://www.tandfonline.com/doi/pdf/10.1080/10627197.2011.634286>
- Yuan, K., & Le, V. N. (2012). Estimating the percentage of students who were tested on cognitively demanding items through the state achievement tests. Santa Monica, CA: RAND Corporation.
- Yuan, K., & Le, V. N. (2014). Measuring deeper learning through cognitively demanding test items. Santa Monica, CA: RAND Corporation.
- Zhao, Y. (2012). *Doublethink: The creativity-testing conflict*. Retrieved from <http://zhaolearning.com/2012/08/16/doublethink-the-creativity-testing-conflict>

Appendix A

Webb Depth of Knowledge Levels

The following descriptions of Webb’s depth of knowledge (DOK) levels are excerpted from the WebAlignment Tool (WAT) Training Manual, Draft Version 1.1 (Webb, 2005, pp. 45–46 and 70–75). DOK levels for ELA and mathematics are described separately.

III. Depth-of-Knowledge-Levels

Section A. Mathematics DOK Levels

Level 1 (Recall) includes the recall of information such as a fact, definition, term, or a simple procedure, as well as performing a simple algorithm or applying a formula. That is, in mathematics, a one-step, well defined, and straight algorithmic procedure should be included at this lowest level. Other key words that signify Level 1 include “identify,” “recall,” “recognize,” “use,” and “measure.” Verbs such as “describe” and “explain” could be classified at different levels, depending on what is to be described and explained.

Level 2 (Skill/Concept) includes the engagement of some mental processing beyond an habitual response. A Level 2 assessment item requires students to make some decisions as to how to approach the problem or activity, whereas Level 1 requires students to demonstrate a rote response, perform a well-known algorithm, follow a set procedure (like a recipe), or perform a clearly defined series of steps. Keywords that generally distinguish a Level 2 item include “classify,” “organize,” “estimate,” “make observations,” “collect and display data,” and “compare data.” These actions imply more than one step. For example, to compare data requires first identifying characteristics of objects or phenomena and then grouping or ordering the objects. Some action verbs, such as “explain,” “describe,” or “interpret,” could be classified at

different levels depending on the object of the action. For example, interpreting information from a simple graph, or reading information from the graph, also are at Level 2. Interpreting information from a complex graph that requires some decisions on what features of the graph need to be considered and how information from the graph can be aggregated is at Level 3. Level 2 activities are not limited only to number skills, but may involve visualization skills and probability skills. Other Level 2 activities include noticing or describing non-trivial patterns, explaining the purpose and use of experimental procedures; carrying out experimental procedures; making observations and collecting data; classifying, organizing, and comparing data; and organizing and displaying data in tables, graphs, and charts.

Level 3 (Strategic Thinking) requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. In most instances, requiring students to explain their thinking is at Level 3. Activities that require students to make conjectures are also at this level. The cognitive demands at Level 3 are complex and abstract. The complexity does not result from the fact that there are multiple answers, a possibility for both Levels 1 and 2, but because the task requires more demanding reasoning. An activity, however, that has more than one possible answer and requires students to justify the response they give would most likely be at Level 3.

Other Level 3 activities include drawing conclusions from observations; citing evidence and developing a logical argument for concepts; explaining phenomena in terms of concepts; and deciding which concepts to apply in order to solve a complex problem.

Level 4 (Extended Thinking) requires complex reasoning, planning, developing, and thinking, most likely over an extended period of time. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require applying significant conceptual understanding and higher-order thinking. For example, if a student has to take the water temperature from a river each day for a month and then construct a graph, this would be classified as a Level 2. However, if the student is to conduct a river study that requires taking into consideration a number of variables, this would be a Level 4. At Level 4, the cognitive demands of the task should be high and the work should be very complex. Students should be required to make several connections—relate ideas *within* the content area or *among* content areas—and have to select one approach among many alternatives on how the situation should be solved, in order to be at this highest level. Level 4 activities include designing *and* conducting experiments and projects; developing and proving conjectures, making connections between a finding and related concepts and phenomena; combining and synthesizing ideas into new concepts; and critiquing experimental designs.

Examples Applied to Objectives and Assessment Items

Sample Mathematics Objectives

Use the mathematics DOK levels on the previous pages to determine the DOK levels for the following five sample objectives. When you are finished, turn the page to see whether you agree with the way *we* coded these objectives! Then try using the DOK levels on the 15 sample mathematics items that follow.

Objective 1. Read, write, and compare decimals in scientific notation.

Objective 2. (Grade 8) Solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of results.

Objective 3. (Grade 8, from the NEAP Mathematics Framework): Design a statistical experiment to study a problem and communicate the outcomes.

Objective 4. Compute with numbers (that is, add, subtract, multiply, divide).

Objective 5. Construct two-dimensional patterns for three-dimensional models, such as cylinders and cones.

DOK Levels of the Sample Mathematics Objectives

Objective 1. *This objective is an example of Level 1. The highest demand for students to successfully meet this expectation requires them to use recall and use a routine method to convert a decimal to scientific notation.*

Objective 2. *This objective is an example of Level 3. The expectation expressed in this objective is that students will not only solve a two-step linear equation, but will also interpret the solution and verify the results. This will require students to do some reasoning in order to interpret the solution and could be fairly complex, depending on the context. If students were only required to solve linear equations and verify solutions, then the expectation would be Level 2.*

Objective 3. *To plan a statistical experiment, a student must define the problem and develop a procedure for solving it. This requires that the student identify the correct statistical model, apply the model to data, and communicate the outcome of the selected model. The student must interpret findings and make reasonable and rationed inferences from obtained data. This represents complex, multistep reasoning and reflects a Level 4 task.*

Objective 4. *This objective requires students to conduct basic calculations. This is Level 1 because it involves routine processing and involves a one-step process.*

Objective 5. *This objective is an example of Level 2. Although recognizing and drawing a two-dimensional pattern, or a regular cylinder, is expected to be routine (Level 1), building a three-dimensional model would not be as routine. It would require at least two steps: first, recognizing the shape and, second, drawing a two-dimensional object to reflect the shape in three dimensions.*

Section C. Reading DOK Levels

In language arts, four DOK levels were used to judge both reading and writing objectives and assessment tasks. The reading levels are based on Valencia and Wixson (2000, pp. 909–935). The writing levels were developed by Marshá Horton, Sharon O’Neal, and Phoebe Winter.

Reading Level 1. Level 1 requires students to receive or recite facts or to use simple skills or abilities. Oral reading that does not include analysis of the text, as well as basic comprehension of a text, is included. Items require only a shallow understanding of the text presented and often consist of verbatim recall from text, slight paraphrasing of specific details from the text, or simple understanding of a single word or phrase. Some examples that represent, but do not constitute all of, Level 1 performance are:

- Support ideas by reference to verbatim or only slightly paraphrased details from the text.
- Use a dictionary to find the meanings of words.
- Recognize figurative language in a reading passage.

Reading Level 2. Level 2 includes the engagement of some mental processing beyond recalling or reproducing a response; it requires both comprehension and subsequent processing of text or portions of text. Inter-sentence analysis of inference is required. Some important concepts are covered, but not in a complex way. Standards and items at this level may include words such as summarize, interpret, infer, classify, organize, collect, display, compare, and determine whether fact or opinion. Literal main ideas are stressed. A Level 2 assessment item may require students to apply skills and concepts that are covered in Level 1. However, items require closer understanding of text, possibly through the item's paraphrasing of both the question and the answer. Some examples that represent, but do not constitute all of, Level 2 performance are:

- Use context cues to identify the meaning of unfamiliar words, phrases, and expressions that could otherwise have multiple meanings.
- Predict a logical outcome based on information in a reading selection.
- Identify and summarize the major events in a narrative.

Reading Level 3. Deep knowledge becomes a greater focus at Level 3. Students are encouraged to go beyond the text; however, they are still required to show understanding of the ideas in the text. Students may be encouraged to explain, generalize, or connect ideas. Standards and items at Level 3 involve reasoning and planning. Students must be able to support their thinking. Items may involve abstract theme identification, inference across an entire passage, or students' application of prior knowledge. Items may also involve more superficial connections

between texts. Some examples that represent, but do not constitute all of, Level 3 performance are:

- Explain or recognize how the author's purpose affects the interpretation of a reading selection.
- Summarize information from multiple sources to address a specific topic.
- Analyze and describe the characteristics of various types of literature.

Reading Level 4. Higher-order thinking is central and knowledge is deep at Level 4. The standard or assessment item at this level will probably be an extended activity, with extended time provided for completing it. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require the application of significant conceptual understanding and higher-order thinking. Students take information from at least one passage of a text and are asked to apply this information to a new task. They may also be asked to develop hypotheses and perform complex analyses of the connections among texts. Some examples that represent, but do not constitute all of, Level 4 performance are:

- Analyze and synthesize information from multiple sources.
- Examine and explain alternative perspectives across a variety of sources.
- Describe and illustrate how common themes are found across texts from different cultures.

Writing Level 1. Level 1 requires the student to write or recite simple facts. The focus of this writing or recitation is not on complex synthesis or analysis, but on basic ideas. The students are asked to list ideas or words, as in a brainstorming activity, prior to

written composition; are engaged in a simple spelling or vocabulary assessment; or are asked to write simple sentences. Students are expected to write, speak, and edit using the conventions of Standard English. This includes using appropriate grammar, punctuation, capitalization, and spelling. Students demonstrate a basic understanding and appropriate use of such reference materials as a dictionary, thesaurus, or Web site. Some examples that represent, but do not constitute all of, Level 1 performance are:

- Use punctuation marks correctly.
- Identify Standard English grammatical structures, including the correct use of verb tenses.

Writing Level 2. Level 2 requires some mental processing. At this level, students are engaged in first-draft writing or brief extemporaneous speaking for a limited number of purposes and audiences. Students are expected to begin connecting ideas, using a simple organizational structure. For example, students may be engaged in note-taking, outlining, or simple summaries. Text may be limited to one paragraph. Some examples that represent, but do not constitute all of, Level 2 performance are:

- Construct or edit compound or complex sentences, with attention to correct use of phrases and clauses.
- Use simple organizational strategies to structure written work.
- Write summaries that contain the main idea of the reading selection and pertinent details.

Writing Level 3. Level 3 requires some higher-level mental processing. Students are engaged in developing compositions that include multiple paragraphs. These compositions

may include complex sentence structure and may demonstrate some synthesis and analysis. Students show awareness of their audience and purpose through focus, organization, and the use of appropriate compositional elements. The use of appropriate compositional elements includes such things as addressing chronological order in a narrative, or including supporting facts and details in an informational report. At this stage, students are engaged in editing and revising to improve the quality of the composition. Some examples that represent, but do not constitute all of, Level 3 performance are:

- Support ideas with details and examples.
- Use voice appropriate to the purpose and audience.
- Edit writing to produce a logical progression of ideas.

Writing Level 4. Higher-level thinking is central to Level 4. The standard at this level is a multi-paragraph composition that demonstrates the ability to synthesize and analyze complex ideas or themes. There is evidence of a deep awareness of purpose and audience. For example, informational papers include hypotheses and supporting evidence. Students are expected to create compositions that demonstrate a distinct voice and that stimulate the reader or listener to consider new perspectives on the addressed ideas and themes. An example that represents, but does not constitute all of, Level 4 performance is:

- Write an analysis of two selections, identifying the common theme and generating a purpose that is appropriate for both.

Examples Applied to Objectives and Assessment Items

Sample Language Arts Objectives

Use the language arts DOK levels on the previous pages to determine the DOK levels for the following five sample objectives. When you are finished, turn the page to see whether you agree with the way we coded these objectives! After this, try using the DOK levels on the Sample Language Arts items.

Objective 1. Identify cause and effect, and understand main idea and purpose implied by text.

Objective 2. Recall elements and details of story structure, such as sequence of events, character, plot, and setting.

Objective 3. Evaluate the relative accuracy and usefulness of information from different sources.

Objective 4. Apply knowledge of grammar and usage, including, but not limited to, parts of speech, punctuation marks, sentence structure, verb tense, and clauses and phrases.

Objective 5. Locate, gather, analyze and evaluate written information for the purpose of drafting a reasoned report that supports and appropriately illustrates references and conclusions drawn from research.

DOK Levels of the Sample Language Arts Objectives

Objective 1. Level 2. Students demonstrate their ability to do more than simply recall an explicitly stated main point. Here, students show basic reasoning skills (generally, understanding why something happens, or summarizing the main points) as they select a statement that best captures the informational emphasis of the article.

Objective 2. Level 1. Students recall specific information from the text.

Objective 3. Level 3. Students must understand a variety of kinds of texts, make inferences across entire passages, and demonstrate the ability to evaluate information according to various criteria. Students must be able to support their thinking.

Objective 4. Level 2. While using correct punctuation is generally a Level 1 activity, correct usage of clauses and phrases is a more complex activity. The range of activities for this objective then makes it a Level 2.

Objective 5. Level 4. Students must gather and analyze information over time, reasoning and supporting their conclusions. The prolonged nature of this research project, given its focus on higher-level analysis, make it a Level 4 objective.

Appendix B

Coding Agenda for Mathematics Standards

Category	Definition	Examples	Coding Rules
Level 1 (recall)	<i>Level 1 (Recall)</i> includes the recall of information such as a fact, definition, term, or a simple procedure, as well as performing a simple algorithm or applying a formula. That is, in mathematics, a one-step, well defined, and straight algorithmic procedure should be included at this lowest level. Other key words that signify Level 1 include “identify,” “recall,” “recognize,” “use,” and “measure.” Verbs such as “describe” and “explain” could be classified at different levels, depending on what is to be described and explained.	Read, write, and compare decimals in scientific notation.	Items at this level require a student to recall a simple definition, term, fact, procedure, or algorithm
Level 2 (skill/ concept)	<i>Level 2 (Skill/Concept)</i> includes the engagement of some mental processing beyond an habitual response. A Level 2 assessment item requires students to make some decisions as to how to approach the problem or activity, whereas Level 1 requires students to demonstrate a rote response, perform a well-known algorithm, follow a set procedure (like a recipe), or perform a clearly defined series of steps. Keywords that generally distinguish a Level 2 item include “classify,” “organize,” “estimate,” “make observations,” “collect and display data,” and “compare data.” These actions imply more than one step. Level 2 activities are not limited only to number skills, but may involve visualization skills and probability	Construct two-dimensional patterns for three-dimensional models, such as cylinders and cones. For example, to compare data requires first identifying characteristics of objects or phenomena and then grouping or ordering the objects. Some action verbs, such as “explain,” “describe,” or “interpret,” could be classified at different	Items at this level require a student to develop some mental connections and make decisions on how to set up or approach a problem or activity to produce a response.

	<p>skills. Other Level 2 activities include noticing or describing non-trivial patterns, explaining the purpose and use of experimental procedures; carrying out experimental procedures; making observations and collecting data; classifying, organizing, and comparing data; and organizing and displaying data in tables, graphs, and charts.</p>	<p>levels depending on the object of the action. For example, interpreting information from a simple graph, or reading information from the graph, also are at Level 2. Interpreting information from a complex graph that requires some decisions on what features of the graph need to be considered and how information from the graph can be aggregated is at Level 3.</p>	
<p>Level 3 (strategic thinking)</p>	<p><i>Level 3 (Strategic Thinking)</i> requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. In most instances, requiring students to explain their thinking is at Level 3. Activities that require students to make conjectures are also at this level. The cognitive demands at Level 3 are complex and abstract. The complexity does not result from the fact that there are multiple answers, a possibility for both Levels 1 and 2, but because the task requires more demanding reasoning. An activity, however, that has more than one possible answer and requires students to justify the response they give would most likely be at Level 3. Other Level 3 activities include drawing conclusions from observations; citing evidence and developing a logical argument for concepts; explaining phenomena in terms of concepts; and deciding which concepts to apply in order to solve a complex problem.</p>	<p>Solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of results.</p>	<p>Items at this level require a student to engage in planning, reasoning, constructing arguments, making conjectures, and/or providing evidence when producing a response. Items at this level require some complex reasoning and</p>

			connections to be made.
Level 4 (extended thinking)	<p><i>Level 4 (Extended Thinking)</i> requires complex reasoning, planning, developing, and thinking, most likely over an extended period of time. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require applying significant conceptual understanding and higher-order thinking. At Level 4, the cognitive demands of the task should be high and the work should be very complex. Students should be required to make several connections—relate ideas <i>within</i> the content area or <i>among</i> content areas—and have to select one approach among many alternatives on how the situation should be solved, in order to be at this highest level. Level 4 activities include designing <i>and</i> conducting experiments and projects; developing and proving conjectures, making connections between a finding and related concepts and phenomena; combining and synthesizing ideas into new concepts; and critiquing experimental designs.</p>	<p>Design a statistical experiment to study a problem and communicate the outcomes.</p> <p>For example, if a student has to take the water temperature from a river each day for a month and then construct a graph, this would be classified as a Level 2. However, if the student is to conduct a river study that requires taking into consideration a number of variables, this would be a Level 4.</p>	<p>Items at this level require a student to engage in complex planning, reasoning, conjecturing, and development of lines of argumentation. Items at this level require a student to make multiple connections between several different key and complex concepts.</p>

Appendix C

Coding Agenda for English Language Arts (ELA) Standards

Category	Definition	Examples	Coding Rules
Level 1 (recall)	<p>Reading Level 1. Level 1 requires students to receive or recite facts or to use simple skills or abilities. Oral reading that does not include analysis of the text, as well as basic comprehension of a text, is included. Items require only a shallow understanding of the text presented and often consist of verbatim recall from text, slight paraphrasing of specific details from the text, or simple understanding of a single word or phrase.</p> <p>Writing Level 1. Level 1 requires the student to write or recite simple facts. The focus of this writing or recitation is not on complex synthesis or analysis, but on basic ideas. The students are asked to list ideas or words, as in a brainstorming activity, prior to written composition; are engaged in a simple spelling or vocabulary assessment; or are asked to write simple sentences. Students are expected to write, speak, and edit using the conventions of Standard English. This includes using appropriate grammar, punctuation, capitalization, and spelling. Students demonstrate a basic understanding and appropriate use of such reference materials as a dictionary, thesaurus, or Web site.</p>	<p>Recall elements and details of story structure, such as sequence of events, character, plot, and setting.</p> <p>Reading: Some examples that represent, but do not constitute all of, Level 1 performance are:</p> <p>Support ideas by reference to verbatim or only slightly paraphrased details from the text.</p> <p>Use a dictionary to find the meanings of words.</p> <p>Recognize figurative language in a reading passage.</p> <p>Writing: Some examples that represent, but do not constitute all of, Level 1 performance are:</p> <p>Use punctuation marks correctly.</p> <p>Identify Standard English grammatical structures,</p>	<p>Items at this level require a student to recall a simple definition, term, fact, procedure, or algorithm</p>

		including the correct use of verb tenses.	
Level 2 (skill/ concept)	<p>Reading Level 2. Level 2 includes the engagement of some mental processing beyond recalling or reproducing a response; it requires both comprehension and subsequent processing of text or portions of text. Inter-sentence analysis of inference is required. Some important concepts are covered, but not in a complex way. Standards and items at this level may include words such as summarize, interpret, infer, classify, organize, collect, display, compare, and determine whether fact or opinion. Literal main ideas are stressed. A Level 2 assessment item may require students to apply skills and concepts that are covered in Level 1. However, items require closer understanding of text, possibly through the item's paraphrasing of both the question and the answer.</p> <p>Writing Level 2. Level 2 requires some mental processing. At this level, students are engaged in first-draft writing or brief extemporaneous speaking for a limited number of purposes and audiences. Students are expected to begin connecting ideas, using a simple organizational structure. For example, students may be engaged</p>	<p>Identify cause and effect, and understand main idea and purpose implied by text.</p> <p>Reading: Some examples that represent, but do not constitute all of, Level 2 performance are:</p> <p>Use context cues to identify the meaning of unfamiliar words, phrases, and expressions that could otherwise have multiple meanings.</p> <p>Predict a logical outcome based on information in a reading selection.</p> <p>Identify and summarize the major events in a narrative.</p> <p>Writing: Some examples that represent, but do not constitute all of, Level 2 performance are:</p> <p>Construct or edit compound or complex sentences, with attention</p>	<p>Items at this level require a student to develop some mental connections and make decisions on how to set up or approach a problem or activity to produce a response.</p>

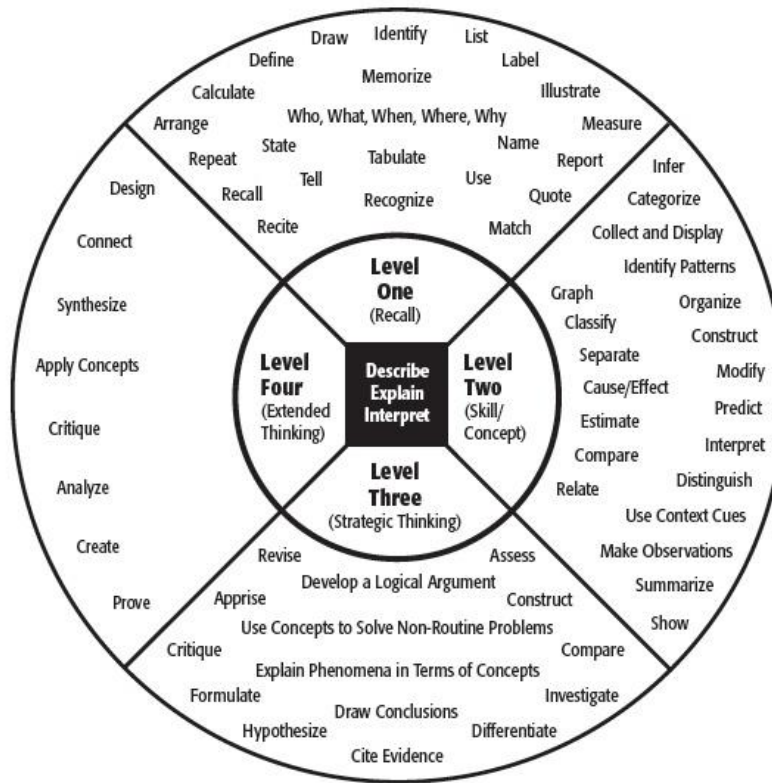
	<p>in note-taking, outlining, or simple summaries. Text may be limited to one paragraph.</p>	<p>to correct use of phrases and clauses.</p> <p>Use simple organizational strategies to structure written work.</p> <p>Write summaries that contain the main idea of the reading selection and pertinent details.</p>	
<p>Level 3 (strategic thinking)</p>	<p>Reading Level 3. Deep knowledge becomes a greater focus at Level 3. Students are encouraged to go beyond the text; however, they are still required to show understanding of the ideas in the text. Students may be encouraged to explain, generalize, or connect ideas. Standards and items at Level 3 involve reasoning and planning. Students must be able to support their thinking. Items may involve abstract theme identification, inference across an entire passage, or students' application of prior knowledge. Items may also involve more superficial connections between texts.</p> <p>Writing Level 3. Level 3 requires some higher-level mental processing. Students are engaged in developing compositions that include multiple paragraphs. These compositions may include complex sentence structure and may demonstrate some synthesis and analysis. Students show awareness of their audience and purpose through focus, organization, and the use of appropriate compositional elements. The use of appropriate</p>	<p>Evaluate the relative accuracy and usefulness of information from different sources.</p> <p>Reading: Some examples that represent, but do not constitute all of, Level 3 performance are:</p> <p>Explain or recognize how the author's purpose affects the interpretation of a reading selection.</p> <p>Summarize information from multiple sources to address a specific topic.</p> <p>Analyze and describe the characteristics of various types of literature.</p> <p>Writing: Some examples that represent, but do not constitute all of, Level 3 performance are:</p> <p>Support ideas with details and examples.</p>	<p>Items at this level require a student to engage in planning, reasoning, constructing arguments, making conjectures, and/or providing evidence when producing a response. Items at this level require some complex reasoning and connections to be made.</p>

	compositional elements includes such things as addressing chronological order in a narrative, or including supporting facts and details in an informational report. At this stage, students are engaged in editing and revising to improve the quality of the composition	Use voice appropriate to the purpose and audience. Edit writing to produce a logical progression of ideas.	
Level 4 (extended thinking)	<p>Reading Level 4. Higher-order thinking is central and knowledge is deep at Level 4. The standard or assessment item at this level will probably be an extended activity, with extended time provided for completing it. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require the application of significant conceptual understanding and higher-order thinking. Students take information from at least one passage of a text and are asked to apply this information to a new task. They may also be asked to develop hypotheses and perform complex analyses of the connections among texts.</p> <p>Writing Level 4. Higher-level thinking is central to Level 4. The standard at this level is a multi-paragraph composition that demonstrates the ability to synthesize and analyze complex ideas or themes. There is evidence of a deep awareness of purpose and audience. For example, informational papers include hypotheses and supporting evidence.</p>	<p>Locate, gather, analyze and evaluate written information for the purpose of drafting a reasoned report that supports and appropriately illustrates references and conclusions drawn from research.</p> <p>Reading: Some examples that represent, but do not constitute all of, Level 4 performance are:</p> <p>Analyze and synthesize information from multiple sources.</p> <p>Examine and explain alternative perspectives across a variety of sources.</p> <p>Describe and illustrate how common themes are found across texts from different cultures.</p>	Items at this level require a student to engage in complex planning, reasoning, conjecturing, and development of lines of argumentation . Items at this level require a student to make multiple connections between several different key and complex concepts.

	<p>Students are expected to create compositions that demonstrate a distinct voice and that stimulate the reader or listener to consider new perspectives on the addressed ideas and themes.</p>	<p>Writing: An example that represents, but does not constitute all of, Level 4 performance is:</p> <p>Write an analysis of two selections, identifying the common theme and generating a purpose that is appropriate for both.</p>	
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Appendix D

Depth of Knowledge (DOK) Levels



Level One Activities	Level Two Activities	Level Three Activities	Level Four Activities
Recall elements and details of story structure, such as sequence of events, character, plot and setting.	Identify and summarize the major events in a narrative.	Support ideas with details and examples.	Conduct a project that requires specifying a problem, designing and conducting an experiment, analyzing its data, and reporting results/solutions.
Conduct basic mathematical calculations.	Use context cues to identify the meaning of unfamiliar words.	Use voice appropriate to the purpose and audience.	Apply mathematical model to illuminate a problem or situation.
Label locations on a map.	Solve routine multiple-step problems.	Identify research questions and design investigations for a scientific problem.	Analyze and synthesize information from multiple sources.
Represent in words or diagrams a scientific concept or relationship.	Describe the cause/effect of a particular event.	Develop a scientific model for a complex situation.	Describe and illustrate how common themes are found across texts from different cultures.
Perform routine procedures like measuring length or using punctuation marks correctly.	Identify patterns in events or behavior.	Determine the author's purpose and describe how it affects the interpretation of a reading selection.	Design a mathematical model to inform and solve a practical or abstract situation.
Describe the features of a place or people.	Formulate a routine problem given data and conditions.	Apply a concept in other contexts.	
	Organize, represent and interpret data.		

Webb, Norman L. and others. "Web Alignment Tool" 24 July 2005. Wisconsin Center of Educational Research. University of Wisconsin-Madison. 2 Feb. 2006. <<http://www.wcer.wisc.edu/WAT/index.aspx>>.

Appendix E

NJCCCS 9-12 Mathematics Depth of Knowledge DOK Coding Template Codes- Mathematics

NJCCCS (MATH) - Standard DOK Coding Sheet				
NJCCS MATH Grades 9-12	2008			
Standard #				
NUMBER AND NUMERICAL OPERATIONS				
<i>STANDARD 4.1 (NUMBER AND NUMERICAL OPERATIONS) ALL STUDENTS WILL DEVELOP NUMBER SENSE AND WILL PERFORM STANDARD NUMERICAL OPERATIONS AND ESTIMATIONS ON ALL TYPES OF NUMBERS IN A VARIETY OF WAYS.</i>	DOK Level 1	DOK Level 2	DOK LEVEL 3	DOK LEVEL 4
4.1.12 A.Number Sense				
4.1.12 A.1.Extend understanding of the number system to all real numbers.				
4.1.12 A.2.Compare and order rational and irrational numbers.				
4.1.12 A.3.Develop conjectures and informal proofs of properties of number systems and sets of numbers.				
4.1.12 B.Numerical Operations				
4.1.12 B.1.Extend understanding and use of operations to real numbers and algebraic procedures.				
4.1.12 B.2.Develop, apply, and explain methods for solving problems involving rational and negative exponents.				
4.1.12 B.3.Perform operations on matrices.•Addition and subtraction•Scalar multiplication				

4.1.12 B.4. Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.				
4.1.12 C. Estimation				
4.1.12 C.1. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine whether the error is within acceptable tolerance limits.				
GEOMETRY AND MEASUREMENT)				
<i>STANDARD 4.2 (GEOMETRY AND MEASUREMENT) ALL STUDENTS WILL DEVELOP SPATIAL SENSE AND THE ABILITY TO USE GEOMETRIC PROPERTIES, RELATIONSHIPS, AND MEASUREMENT TO MODEL, DESCRIBE AND ANALYZE PHENOMENA.</i>	DOK Level 1	DOK Level 2	DOK LEVEL 3	DOK LEVEL 4
4.2.12 A. Geometric Properties				
4.2.12 A.1. Use geometric models to represent real-world situations and objects and to solve problems using those models (e.g., use Pythagorean Theorem to decide whether an object can fit through a doorway).				
4.2.12 A.2. Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views).				
4.2.12 A.3. Apply the properties of geometric shapes. • Parallel lines – transversal, alternate interior angles, corresponding angles • Triangles a. Conditions for congruence b. Segment joining midpoints of two sides is parallel to and half the length of the third side c. Triangle Inequality d. Special right triangles • Minimal conditions for a shape to be a special quadrilateral • Circles – arcs, central and inscribed angles, chords, tangents • Self-similarity				

Appendix F

Understanding and Using the Depth-of-Knowledge (DOK) Levels

Interpreting and assigning DOK levels both to objectives within standards and to assessment items is an essential requirement of alignment analysis.

Before beginning the review process, you should be adequately trained to identify, understand, and apply the different DOK levels for items and objectives within their content area.

DOK Level	Title of Level
1	Recall
2	Skills and Concepts
3	Strategic Thinking
4	Extended Thinking

Detailed definitions, explanations, and examples for the DOK levels in mathematics, science, and reading/language arts are provided in **Part III**. After developing a strong understanding of the different DOK levels, your task for each study is to assign a DOK level to each objective within the grade level of that study. The following guidelines are helpful when considering which DOK level to assign an objective:

- The DOK level of an objective should be the level of work students are most commonly required to perform at that grade level to successfully demonstrate their attainment of the objective.

- The DOK level of an objective should reflect the *complexity* of the objective, rather than its *difficulty*. The DOK level describes the kind of thinking involved in a task, not the likelihood that the task will be completed correctly.
- In assigning a DOK level to an objective, think about the complete domain of items that would be appropriate for measuring the objective. Identify the depth-of-knowledge level of the most common of these items.
- If there is a question regarding which of two levels an objective addresses, such as Level 1 or Level 2, or Level 2 or Level 3, it is usually appropriate to select the higher of the two levels.
- The team of reviewers should reach consensus on the DOK level for each objective before coding any items for that grade level.

Appendix G

Tips for Facilitating the Consensus Process	
1.	Read each objective aloud before discussing it.
2.	As you go through the objectives, actively solicit comments from all reviewers. Pay special attention to making sure that the reviewers from within the state feel involved. (Not every reviewer needs to address every objective, but make sure that everyone is included in the process.)
3.	Use your print-out to call on people who coded DOK levels differently from the coding of other members of the group, and ask them to explain why they coded the objective to the particular DOK level. Be sure they use the DOK definitions to justify their answers.
4.	Once two reviewers have described how they have coded an objective differently, ask a third reviewer to highlight the differences between these two interpretations.
5.	Restate and summarize to reviewers your interpretation of what the reviewers have agreed on and what they have disagreed on.
6.	If there is a difference in interpretation of the objective's <i>terminology</i> or <i>expectations</i> , appeal to a reviewer with experience in teaching that grade level with these standards to discern how the state's teachers might be interpreting the objective.
7.	Ask if anyone, through other reviewers' explanations, now wants to change his or her mind about their original coding.
8.	If the viewpoints on the DOK level of an objective are divided, point to the most likely skills or content knowledge required in the objective, not the more extreme possibilities the objective might allow for.
9.	As the facilitator, try not to dominate the consensus process. Even if you have strong feelings about the DOK level of an objective, wait to see if other reviewers highlight your point.